

SEAFDEC Asian Aquaculture



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A publication of the Aquaculture Department of the Southeast Asian Fisheries Development Center
Volume XXII Number 6 November-December 2000

ISSN 0115-4974

The Southeast Asian Fisheries Development Center (**SEAFDEC**) is a regional treaty organization established in December 1967 for the purpose of promoting fisheries development in Southeast Asia. Its Member-Countries are Japan, Malaysia, the Philippines, Singapore, Thailand, Brunei Darussalam, the Socialist Republic of Viet Nam, Union of Myanmar, and Indonesia. Four departments were established in the Member-Countries; one of them, the Aquaculture Department (**AQD**) located in the Philippines, pursues aquaculture research and development

This newsletter **SEAFDEC Asian Aquaculture (SAA)** reports on sustainable aquaculture. It is intended for fishfarmers, aquaculturists, extensionists, policymakers, researchers, and the general public. **SAA** is published six times a year by SEAFDEC/AQD.

<i>editor</i>	MT Castaños
<i>writers</i>	MB Surtida AP Surtida RIY Adan E Gasataya
<i>design&layout</i>	MT Castaños
<i>artwork</i>	E Ledesma I Tendencia
<i>photography</i>	R Buendia
<i>circulation</i>	MB Surtida LH Plondaya E Ledesma
<i>editorial adviser</i>	PL Torres Jr.

Editorial offices are located at the:
Training and Information Division
SEAFDEC Aquaculture Department
Tigbauan 5021, Iloilo, Philippines

tel. 63 (33) 335 1009, 336 2891,
336 2937, 336 2965, 511 9050
fax 63 (33) 336 2891, 335 1008
e-mail devcom@aqd.seafdec.org.ph

You may also contact the editorial staff through:

AQD Manila Office
17 Times Street, West Triangle
Quezon City 1101, Philippines
tel. 63 (2) 372 3980 to 82
fax 63 (2) 372 3983
email mlo@i-loilo.com.ph

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We accept articles that focus on issues, developments, and information on all phases of sustainable aquaculture for publication in this newsletter. Photographs and line drawings must be camera-ready, glossy B&W prints or colored slides. The newsletter editor reserves the right to edit contributed articles for brevity and style.

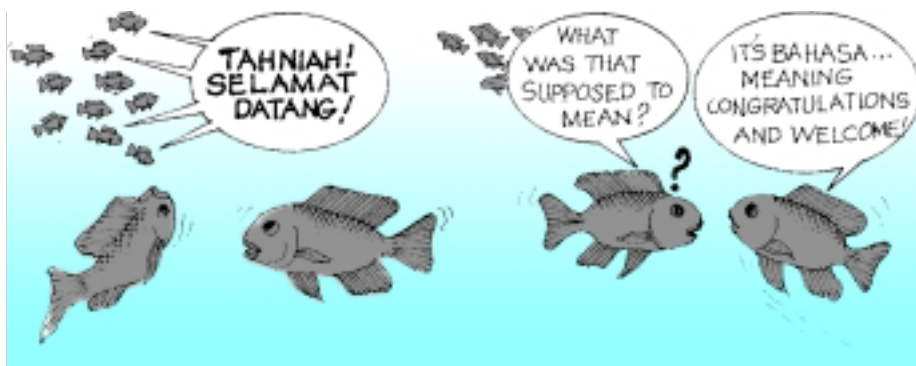
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OUR COVER

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Consultations on aquaculture held

SEAFDEC's program on the *Regionalization of the Code of Conduct for Responsible Fisheries – Aquaculture Development (RCCRF-AD)* moved another step towards completion.

SEAFDEC/AQD recently hosted the first meeting of core experts in Iloilo City from November 21 to 22. These core experts are government representatives from the member countries of SEAFDEC and ASEAN – Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam and Japan.

FAO/RAP, the SEAFDEC Secretariat, and SEAFDEC/AQD were also well-represented by their senior technical staff.

The core experts clarified that the regional guidelines or code would cover only the aquaculture part of “culture-based fisheries” (the provision of seed stock) and not the fishery management of the harvestable stocks, as this does not fall under Article 9 (aquaculture development) of the FAO's global code for aquaculture. The core experts also discussed the relevant definitions of terminology to be used in the code, taking note of the need to standardize the terms to fit the regional setting.

Furthermore, the experts scrutinized the technical provisions of the draft regional guidelines corresponding to Article 9.1 to 9.4 of the same FAO code. Among the important provisions noted as especially relevant to the Southeast Asian region are — (1) species introduction from one region or ecosystem to another within the same country; (2) the responsibility of States to assist small farm holders in complying with responsible aquaculture practices; (3) the use of aquatic genetic resources, and; (4) the inclusion of mangrove ecosystem and mangrove-friendly aquaculture.

During the closing ceremony of the consultation, SEAFDEC/AQD Chief Dr. Rolando Platon said that the regionalization of the FAO code would be a long process considering the complexity of the fisheries situation in the region. He thanked the core experts for their substantial inputs. He also announced that the core experts have agreed to serve as national coordinators for RCCRF-AD in their respective countries.

Following the meeting, on November 23 to 24, the same group of experts discussed the preparations for what has been dubbed as the SEAFDEC/ASEAN Millennium Conference. The experts finalized the themes and subthemes pertaining to the aquaculture sessions. The conference will identify the prioritized programs for SEAFDEC.



The meeting in progress



The FAO/RAP representatives

SEAFDEC/AQD officials and country representatives (bottom)



Representatives from Thailand and Myanmar visit AQD's brackishwater ponds

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AQD holds workshop on genetics and breeding

To rationalize plans for its genetic research strategies on fish and crustacean broodstock development and management, SEAFDEC/AQD held a *Broodstock Management and Genetic Selection Workshop* on November 27 to 29 in Iloilo City. Harnessing the principles of genetics for aquaculture can serve to fill the food security gap by improving techniques in fish farming and creating new, better products.

Four invited scientists presented their experiences and lent their expertise to help AQD decide on approaches to a selective breeding program for priority aquaculture species. Professor John Benzie of the University of New South Wales, Australia, presented an array of techniques and their application for the genetic improvement of farmed aquatic fishes and crustaceans. Dr. Sirawut Klinbunga of BIOTEC, Thailand, described his government's recent efforts on selective breeding of the giant tiger shrimp. Dr. Roy Danzmann of the University of Guelph, Canada, talked about the application of molecular markers to pedigree analysis in aquaculture. Lastly, citing his experience in salmon farming and ranching, Dr. Noel Wilkins of the National University of Ireland discussed mechanisms to avoid the possible genetic pitfalls of an aquaranching program.

During the workshop that followed, matrices were formulated to assist in decision-making. One matrix listed AQD's candidate aquaculture species, their degree of domestication along with other attributes that can lend itself to an effective selective breeding program. Because of their relatively advanced degree of domestication and level of information on genetic variability, four farmed species -- milkfish, sea bass, mud crab, tilapia -- were the focus of another matrix to assess the application of practical methodologies, with prime consideration on cost-efficiency, that AQD may implement.

The experts say that, from their experiences, the decision to embark on a selective breeding program would start with the industry's clamor for better stocks. The degree of domestication of candidate species would also be a critical factor.

The workshop was attended by about 30 discussants from universities and research centers in the Philippines, including AQD researchers.



L-R: Dr. John Benzie, Dr. Clarissa Marte (AQD's research head who organized the meeting), Dr. Noel Wilkins, and Dr. Roy Danzmann



Dr. Sirawut Klinbunga (above) and participants from local universities



Participants later visited AQD's Tigbauan Main Station (above) and Dumangas Brackishwater Station

SEAFDEC/AQD programs in compact disc

AQD has produced, with the help of UniMatrix IT, a private production company, a CD on its current programs. The presentation is divided into the institutional part and the commodities area.

The first part covers the general information about SEAFDEC and its four departments including AQD, and access is by clicking on the Asian and Philippine maps. An introductory video is also included.

The commodities part features different aquatic organisms that AQD does research on. Among them are rabbitfish, sea bass, tilapia, Asian catfish, mudcrab, abalone, window-pane oyster, green mussel, seaweeds, seahorse and mangrove snapper. Those with video clips include milkfish, grouper, tiger shrimp, oyster and bighead carp. Moreover, clicking on the SEAFDEC logo at the center will lead to the video presentation *Conserving our mangrove forests* that highlights AQD's efforts on mangrove conservation and mangrove-friendly aquaculture.



New publication

SEAFDEC/AQD recently released a how-to-manual entitled "Environment-friendly schemes in intensive shrimp farming." It is written by Dan Baliao, head of AQD's technology verification and extension section.

The manual details the procedures of intensive shrimp farming but with provisos for the treatment of sludge and water. These provisos include (1) the use of water reservoir where pond water is stored for at least a week before being used in the grow-out ponds, (2) the use of a "tail" pond to hold drained water so it can be treated and recycled, (3) the use of long-arm paddle wheel so water aeration-circulation is made more efficient, and (4) the use of fishes to help condition the water and substantially produce green water.

Meanwhile, a complementary guidebook entitled "Closed-Recirculation Shrimp Farming System" is nearing completion. This is authored by Siri Tookwinas, a Thai working for his government's fisheries department. The guidebook is part of the ASEAN/SEAFDEC project on the *Development of mangrove-friendly shrimp culture technology*. The project is partly funded by the Japanese Government through a trust fund.



Author Dan Baliao (right) confers with AQD economist RF Agbayani after he introduced the manual to the public



*For copies of this manual, contact:
sales@aqd.seafdec.org.ph*

New training-information head for AQD



Mr. Pastor Torres Jr. has been appointed Head of SEAFDEC/AQD's Training and Information Division effective December 18. An engineer by profession, Mr. Torres has extensive experience in managing aquaculture projects and extension programs. Just prior to rejoining AQD, he was the aquaculture engineer of PT Wachyuni

Mandira, probably the largest shrimp farm in the world, for five years. He was also the Vice-President of a consultancy group — the Systems Aquaculture and Management, Inc — which had clients in the Philippines, India, and Indonesia (1986-1995). His previous stint at AQD (1973-1986) was as Head of Personnel, Head of the Leganes Brackishwater Station, and Director of Training and Extension.

Mr. Torres is a graduate of Mindanao State University (BS Electrical Engineering, 1967, *cum laude*) and University of the Philippines (M Engineering, 1968).

AQD celebrates year's end and its accomplishments in 2000



SEAFDEC/AQD employees received a pat on their backs when AQD Chief Dr. Rolando Platon declared himself more than satisfied with the department's accomplishments in 2000. During the official department party in Iloilo on December 15 where he delivered the christmas message, he cited the increasing visibility and respect AQD is getting from the private sector.

The most popular technology packages are: hatchery of the native catfish *Clarias macrocephalus*, the hatchery and grow-out of the mudcrab *Scylla serrata*, and tilapia grow-out using the strain developed by AQD's Binangonan Freshwater Station. Dr. Platon also cited the success of the conferences which brought the world's aquaculture experts to Iloilo, and the patents on milkfish and siganid growth hormones that the Philippine government is expected to grant anytime soon.

In addition, Dr. Platon said, the collaboration on technology verification and extension with Philippine government agencies

and the private sector, Thailand, and Vietnam especially on environment-friendly shrimp culture and mudcrab culture in mangrove areas is a thing to be proud of.

"Since food security is an urgent, on-going agenda, let us work harder next year," he enjoined the employees. He noted that research collaboration will be greater next year as a result of the participation of scientists from other SEAFDEC member-countries in addition to scientists from AQD's host country, the Philippines.

There will also be a new dimension to AQD's training activities, in particular, the emphasis on the entrepreneurial aspect of aquaculture. AQD will also conduct more on-site training-demonstration projects, and there is a plan to start such a project in Myanmar. For information dissemination, AQD will upgrade its information technology capabilities.

AQD celebrates year's end with a christmas program, a seafood festival (bottom picture), and christmas card-lantern contest for schoolchildren. The last two were organized by FishWorld, AQD's museum-aquarium-ecopark



— AQD News by RIY Adan and MT Castaños



AQD Research Publications

Reprints of papers listed here may be requested directly from AQD authors or from the AQD Library

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Agbayani RF. 2000. Property rights and collective action in the management of mangrove ecosystems: Implications of the adoption of mangrove-friendly aquaculture. IN: Primavera JH, Garcia LMB, Castanos MT, and Surtida MB. 2000. Mangrove-Friendly Aquaculture. SEAFDEC/AQD, Iloilo, Philippines. 217 pages

Abstract. The SEAFDEC/AQD experience in Malalison Island on the Community Fishery Resources Management Project is well used in the Aklan project on community-based mangrove-friendly aquaculture. The territorial use rights in fisheries that was implemented in Malalison has become a model in investigating property rights regime in state-owned mangrove areas in Iloilo, Aklan. The concept of property rights as a management strategy in arresting the further destruction of mangroves and rehabilitating destroyed mangrove forest requires the collective effort of different users and stakeholders. There is a need to balance environmental conservation and food security in the management of mangrove resources.

Agbayani RF and Corre KG. 2000. SEAFDEC/AQD experience in mangrove-friendly aquaculture training and extension. IN: Primavera JH, Garcia LMB, Castanos MT, and Surtida MB. 2000. Mangrove-Friendly Aquaculture. SEAFDEC/AQD, Iloilo, Philippines. 217 pp

Abstract. SEAFDEC Aquaculture Department (SEAFDEC/AQD) is mandated to develop human resources and disseminate and exchange information in aquaculture. Towards this direction, AQD's recent thrusts are focused on the verification, packaging, and commercialization of the technologies developed through research. AQD disseminates and exchanges information on aquaculture research and technology through training, extension services, community-based projects and mass media. Through these strategies, AQD aims to reach out to more clientele which include among other sectors the private industry, research and academic institutions, regional and international organizations, policy-makers, non-government organizations, resource managers, SEAFDEC member-countries, local and national government and the fisherfolk.

For the past two years, the scope of training courses and extension services of AQD have been expanded from technological viability to sustainability i.e., technological feasibility, economic viability, environmental sustainability and social equity. To attain sustainable aquaculture the following elements were considered: status of technology, conditions of the coastal resources, socio-economic attributes of the community and other

stakeholders and institutional arrangements on sustainable aquaculture.

Starting 1997, subjects on mangrove-friendly aquaculture and coastal resource management were incorporated into the curriculum of training courses. These courses are the following:

- Third Country Training Program on Coastal Aquaculture and Resource Management for trainees from Asian countries
- On-site Training on Sustainable Aquaculture and Coastal Resource Management in Vietnam
- Sustainable Aquaculture and Coastal Resource Management for extension workers and fishery school teachers

In terms of technology verification and extension, the culture of mudcrab (*Scylla* sp.) was tested in mangroves or tidal flats with existing mangroves in two different sites (Puerto Princesa, Palawan and Kalibo, Aklan) in collaboration with local government units and the fisherfolk. These activities started in 1997 and will be replicated in other areas of the country. Also in 1997, AQD published and distributed an issue on integrated farming with aquasilviculture in its SEAFDEC *Asian Aquaculture* newsletter. In 1998, AQD produced a 12-minute video on *Conserving Mangrove Resources*.

de Castro-Mallare TR. 2000. Mangrove-associated mollusc research at SEAFDEC/AQD. IN: Primavera JH, Garcia LMB, Castanos MT, and Surtida MB. 2000. Mangrove-Friendly Aquaculture. SEAFDEC/AQD, Iloilo, Philippines. 217 pp

Abstract. Mollusc research at the Aquaculture Department of the Southeast Asian Fisheries Development Center started in 1975 and focused on two commercially important mangrove-associated bivalves, the slipper-shaped oyster (*Crassostrea iredalei*) and the green mussel (*Perna viridis*). Studies conducted were on spatfall forecasting to increase collection of seeds from the wild; improvement of farming techniques; seed production in the hatchery; bivalve sanitation; and transplantation. These studies have led to the development of a suitable spat collector for oyster and mussel; promotion of the raft culture method for oysters and mussels to prevent siltation of growing areas, including a low-cost raft designed for this purpose; refinement of transplantation techniques to increase production and to grow oyster and mussel in suitable areas without natural populations; and design of a prototype low-cost depuration unit.

A socio-economic study of oyster and mussel farming practices in Western Visayas provided information on current farm-

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ing practices and profitability. A study done on the use of green mussels as biofilter in a semi-intensive shrimp pond showed that shrimp stocked with mussels grew faster than those without.

A study on the biology and fishery of the "imbao" *Anodontia edentula*, another mangrove-associated bivalve, is ongoing. Spawning has been achieved in the laboratory and larval stages monitored were first polar body, 2-cell stage, morula, ciliated gastrula, trocophore, veliger, and pediveliger.

Gallardo WG, Hagiwara A, Snell TW. 2000. Effect of juvenile hormone and serotonin (5-HT) on mictic induction of the rotifer *Brachionus plicatilis* Muller. *Journal of Experimental Marine Biology & Ecology* 252 (1): 97-107

Abstract. Juvenile hormone (JH) and serotonin (5-HT) were previously shown to enhance mictic (sexual) female production of the rotifer *Brachionus plicatilis* in batch cultures. To explore the basis of these effects, experiments were conducted on isolated individuals. JH treatment of maternal rotifers with 5 and 50 $\mu\text{g ml}^{-1}$ (18.8 and 187.7 μM) resulted in significantly higher ($P < 0.05$) mictic female production in the second (F_2) and third (F_3) generations. JH treatment was effective even at a lower food concentration of 7×10^5 cells ml^{-1} , but it was not effective when free ammonia was added at 2.4 and 3.1 $\mu\text{g ml}^{-1}$. Mictic female production was not increased with exposure to 5-HT up to 50 $\mu\text{g ml}^{-1}$ (129.1 μM) concentrations. When food level was reduced to 7×10^5 cells ml^{-1} , however, 5-HT-treated rotifers produced significantly ($P < 0.05$) more mictic females than the control, particularly in F_3 generation. Mictic female production of 5-HT-treated rotifers did not differ from that of the control with or without free ammonia, but the intrinsic rate of natural increase (r) of 5-HT-treated rotifers at 3.1 $\mu\text{g ml}^{-1}$ free ammonia was significantly higher than the control. These results show that juvenile hormone increases mictic female production under optimum and sub-optimum food levels, whereas 5-HT increases both mictic female production at low food level and population growth rate at high free ammonia concentrations. These compounds could be used to manage rotifer cultures and probe the mechanisms controlling the rotifer life cycle as it switches to mictic reproduction.

Garcia LMB, Toledo JB, and RF Agbayani. 2000. Marine fishes and coastal resource management: Mangrove-friendly development strategies. IN: Primavera JH, Garcia LMB, Castanos MT, and Surtida MB. 2000. Mangrove-Friendly Aquaculture. SEAFDEC/AQD, Iloilo, Philippines. 217 pp

Abstract. Recent statistics of fishery production in the Philippines reveal outputs that are either declining (municipal fishery) or levelling off (commercial fishery and aquaculture). These trends are, in part, a reflection of the serious effects of unregulated economic activities in the coastal zone. The degradation of

coastal ecosystems means a loss of livelihood among many communities of impoverished fishers as catches from municipal waters have declined over the years. Considering that mangroves, seagrasses, and coral reefs are vulnerable to anthropogenic perturbations, several development strategies are presented to meet the twin issues of ecosystem conservation and food security for coastal fishing communities. Mariculture, searanching, habitat alteration and restoration are a few of these strategies. Our recent experience in village-based reef resource management in Mararison Island, central Philippines may likewise be a viable option in the management of shoreward ecosystems (mangroves and seagrasses). In particular, the establishment of a marine reserve in the island may find some relevant applications in mangrove management and development.

Primavera JH. 2000. Development and conservation of Philippine mangroves: institutional issues. *Ecological Economics* 35 (Special Issue): 91-106

Abstract. The decline of Philippine mangroves from half a million hectares in 1918 to only 120 000 ha in 1994 may be traced to local exploitation for fuelwood and conversion to agriculture, salt beds, industry and settlements. But brackishwater pond culture, whose history is intertwined with that of mangroves, remains the major cause of loss. The paper discusses the institutional issues - aquaculture as development strategy, low economic rent of mangroves, overlapping bureaucracy and conflicting policies, corruption, weak law enforcement and lack of political will relevant to this decline. Recommended policies are based on these institutional factors and the experiences in mangrove rehabilitation including community-based efforts and government programs such as the 1984 Central Visayas Regional Project. These recommendations include conservation of remaining mangroves, rehabilitation of degraded sites including abandoned ponds, mangrove-friendly aquaculture, community-based and integrated coastal area management, and provision of tenurial instruments.

Primavera JH, Lebata MJHL. 2000. Size and diel differences in activity patterns of *Metapenaeus ensis*, *Penaeus latisulcatus* and *P. merguensis*. *Marine Behavior & Physiology* 33 (3): 173-185

Abstract. The nursery function of mangroves as shelter has been postulated to explain the positive correlation between shrimp catches and mangrove area. This study was undertaken to document shelter use and other activities in mangrove-associated penaeids and to determine diel and size differences relating to these activities. Juvenile *Metapenaeus ensis*, *Penaeus latisulcatus* and *P. merguensis* collected from mangrove areas in Guimaras, central Philippines and stocked individually in glass tanks (=replicates) provided with artificial shelters and sand substrate were observed every hour for 25 h. Size classes tested were very small

(1-5.9 mm carapace length); small (6-10.9 mm CL); medium (11-15.9 mm CL); large (16-20.9 mm CL); and very large (21-25.9 mm CL). Due to limited juvenile supply, only 3 sizes were tested for each species: *P. merguensis* (very small to medium), *M. ensis* (small to large) and *P. latisulcatus* (medium to very large) with 5 replicate animals (one per tank) per size. Juvenile *M. ensis* and *P. latisulcatus* showed a strong diel periodicity of daytime burial and nocturnal activity. In contrast, *P. merguensis* showed active swimming and feeding throughout the day and night. Very small to small *P. merguensis* were observed on the shelters, but burying was exhibited only by a few medium-sized juveniles. This shelter use is consistent with observations of small *P. merguensis* entering the mangrove forest (where roots, twigs, etc. contribute to structural complexity) on the flood tide and concentrating in the shallow, turbid waters of adjoining creeks during ebb tide and slack water.

Ronnback P, **Primavera JH**. 2000. Illuminating the need for ecological knowledge in economic valuation of mangroves under different management regimes - a critique. *Ecological Economics* 35: 135-141

Abstract. This is a commentary on a paper by Gilbert and Janssen (Gilbert AJ, Janssen R. 1998. *Econ.* 25: 323-346) that deals with valuation of management alternatives for the Pagbilao mangroves, Philippines. Our main critique focuses on the under-valuation of fisheries as well as the inability to quantify the value of ecological services and internalize aquaculture's environmental costs. In addition, the sustainability criteria set up for the aquaculture management alternatives is open to debate. These weaknesses affect the result of Gilbert and Janssen's analysis so that the value of the unexploited mangrove forest is underestimated, and the value and sustainability of converting the forest into aquaculture ponds are overestimated. If applied to decision-making, the erroneous results from this partial cost-benefit analysis may have dire consequences for the mangroves and coastal communities of Pagbilao.

Triño AT and **Rodriguez EM**. 2000. Mudcrab (*Scylla serrata*) culture in tidal flats with existing mangroves, IN: Primavera JH, Garcia LMB, Castanos MT, and Surtida MB. 2000. Mangrove-Friendly Aquaculture. SEAFDEC/AQD, Iloilo, Philippines. 217 pp

Abstract. The performance of the mudcrab *Scylla serrata* (Forsskal) in 200 m² pens installed in tidal flats with existing mangroves was determined in a factorial experiment with stocking density (0.5 or 1.5/m²) and feed (salted fish by-catch or a mixed diet of 75% salted brown mussel flesh and 25% salted fish by-catch) as main factors. Duration of the experiment was 160 days. Results showed no interaction between feed and stocking density so data were pooled for each feed and stocking den-

sity treatment. There was no significant differences in growth, feed conversion ratio (FCR), survival, and production among two types of feed. Regardless of feed, the FCR was significantly more efficient and survival significantly higher at 0.5 than at 1.5/m² stocking density. Growth, however, was not significantly different. Cost-return analysis on a per crop/200 m² basis showed that the use of either of the two stocking density levels with either of the two types of feed was economically viable with a return on capital investment of 65-87%. Partial budgeting analysis, however, revealed that net earnings were increased by P1,128.00 if crabs were stocked at 1.5/m² and P881.00 if fed a mixed diet of 75% salted brown mussel flesh and 25% salted fish by-catch compared with crabs stocked at 0.5/m² and fed salted fish by-catch alone.

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SEAFDEC/AQD's Dumangas Brackishwater Station takes centerstage in reviving the shrimp industry

By **ET Aldon**

The giant tiger shrimp industry was once dubbed as the sunshine industry. The market demand in the Philippines in the '80s was very high, growing at 2.5% per year, and was expected to last until the 21st century. But this demand started declining in the '90s and was attributed to disease outbreaks due to poor water quality brought about by the undesirable pond management practices of the industry itself. Because of this, shrimp growers lost heavily after several failed runs. Some growers were left with no choice; they either stopped operating or shifted to culturing other species. By the early '90s, the shrimp industry in the country was virtually dead.

The slump of the shrimp industry taught growers a costly lesson -- that the environment is important to the sustainability of aquaculture. Industry leaders thus appealed to government and research institutions to help them revive the industry. For despite the huge losses they incurred, the promise of huge profits in shrimp culture was irresistible.

The government response -- through then Department of Agriculture Secretary Salvador Escudero III -- was to organize a task force, called the *Oplan Sagip Sugpo*, on September 16, 1996. The Chief of SEAFDEC/AQD, Dr. Rolando Platon, was appointed Chairperson, and the staff of the different aquaculture research and academic institutions were designated as task force members.

The task force was mandated to hasten the rehabilitation of the shrimp culture industry, and to set the R&D direction of shrimp health management and production aspects.

The task force gave SEAFDEC/AQD the responsibility of working on practical schemes that could minimize or control

shrimp disease outbreaks. And by 1997, the outline of a working technology emerged. Oplan Sagip-Sugpo began testing it in private farms in Negros Occidental and at AQD's brackishwater station north of Iloilo City.



SEAFDEC/AQD's Dumangas Brackishwater Station in the central Philippine island of Panay

AQD's Dumangas Brackishwater Station (DBS)

DBS is a 16 hectare pond complex situated at Bgy. Bantud Fabrica,

Dumangas, located 20 kilometers north of Iloilo City. At DBS, AQD's banner program on aquaculture technology verification, demonstration, and transfer is carried out. Various technologies are verified and tested here before they are extended to the private sector. AQD's Technology Verification and Extension Section (TVES) headed by Mr. Dan Baliao implements the program.

One of the technologies that TVES has successfully verified in Negros Occidental in collaboration with the Negros Prawn Producers' Marketing Cooperative Inc. was the environment-friendly scheme in intensive shrimp farming. Subsequent runs were conducted at DBS to validate and fine-tune the same technology and improve its sustainability. DBS also showcases a sustainable integrated aquaculture system that may be operated as a zero discharge facility in the future.

Environment-friendly schemes in shrimp farming*

Although AQD does not recommend intensive culture of shrimp for environmental reasons, AQD Chief Dr. Platon believes that shrimp growers should not be left alone in their present predicament.

* The project is partially funded by the SEAFDEC-BFAR Joint Mission and the Japanese Trust Fund

ment. “We must deal with aquaculture wastes,” he said. “The best way is to reduce the organic load of pond effluents on-farm and to keep on recycling pond water. Our aim is to keep the shrimp farm from impacting too much on surrounding ecosystems.”

With profitability and sustainability thus in mind, several environment-friendly schemes in intensive shrimp farming were developed. As described below, the schemes include the use of reservoirs, fish biomanipulators, improved aeration, low salinity and bioaugmentation.

The use of biomanipulators

All male adult tilapia or milkfish are stocked in separate cages in a reservoir, the water from which is used in the grow-out ponds. A rectangular sludge collector is installed at the center of the grow-out pond where 3,000 pieces of adult tilapia or milkfish are also stocked. Tilapia, milkfish, and siganids serve as biomanipulators of the pond environment. The greenwater that they produce are observed to counter bacteria harmful to the shrimp.

Improved aeration

Four long-arm paddle wheel aerators are installed with the capability of spinning the water around the sludge collector to concentrate the waste at the center. This prevents the contact of shrimp with the sludge. Further, the aerators also provide enough circula-



Schemes to make shrimp culture more environment-friendly and profitable

1: Nylon substrates are installed 1.5 meters apart from each other and 1 cm from the bottom to serve as attachment for natural food organisms. Nylon substrates increase the surface area by 50%

2: Bottom aerators improve aeration and water quality by accelerating the removal of suspended particles and push them towards the drain pipe

3: The treatment pond or tail reservoir is 25% of the pond area; molluscs and filamentous algae are stocked to serve as biofilters and fishes serve as biomanipulators

tion and turns over the water for better penetration of sunlight to maintain the desired plankton level.

Low salinity

Low salinity is maintained at 22 ppt during initial stocking and is gradually reduced to 16 ppt after 60 days of culture (DOC), then to 15 ppt after 90 DOC until the desired salinity of 8 ppt.

Bioaugmentation

Microbial inoculants are introduced to enhance the growth and dominance of micro-organisms beneficial to the shrimp population in the pond over the non-beneficial or pathogenic microbes. The bacterial and phytoplankton levels are intensively monitored to prevent the outbreak of diseases.

The use of reservoirs

Two reservoir ponds are used. Water pumped in from the river is allowed to settle in the reservoir pond for at least one day before it is used to change or replenish the water of growout ponds.

Regular monitoring

Pond water temperature, transparency, salinity, and depth are monitored daily. AQD's Fish Health Section checks the microbiological level in the pond water twice a week while the bacterial level of the fry is determined twice a month.

The use of a zero discharge system, or the closed recirculating system, is recommended in places where a clean water source is a problem.

Closed recirculating system

This is the recent shrimp culture system being tested at DBS, primarily to control the outbreak of the

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dreaded white spot syndrome virus (WSSV). Although this system is more complex and expensive, it is the most environment-friendly for it does not discharge effluents to natural waterways.

With a well-managed reservoir as initial water source, the close-recirculating system requires a tail reservoir that serves as a treatment pond. It is about 25% of the total pond area and is stocked with molluscs and filamentous algae that serve as biofilters and with fishes that serve as biomanipulators. Filtered water from the treatment pond is pumped into the grow-out ponds using a submersible pump. Water from the grow-out pond flows back to the treatment pond through a drain pipe. Bottom aeration and paddle wheel aerators are used to improve aeration and water quality. They accelerate the removal of suspended particulates by pushing them towards the drain pipe. The nylon screen substrate technology in grow-out ponds is a great help because it increases the surface area of the pond bottom by 50 to 75% for attachment of natural food organisms.

Using the closed system, the four 1,000 m² ponds stocked at 60 pieces per m² yielded an average of 7.8 tons per hectare with 18 g shrimp on average, 72% survival after over four months of culture.

The harvest of less than marketable sizes of shrimp is an attempt to compare the profitability and return-on-investment between, say, 18 g shrimp with a shorter culture period and 30g shrimp with a prolonged culture period. Says TVES Head Dan Baliao: "If there is market for small shrimp, it may be better than lengthening the culture period, and incurring more expenses for the maintenance." Mr. Baliao plans to go into more commercial operations this year following the encouraging results of the closed recycling system. More collaboration with the Bureau of Fisheries and Aquatic Resources (BFAR) and the private sector is in the offing.

Reviving the shrimp industry

There are indications that the shrimp industry may yet get back its lost glory. The new schemes that AQD has adopted proved to be profitable, and had less negative impact to the environment. The culture system is practically shooting two birds with one stone.



4: This PVC pipe is attached to the submersible pump; water from the treatment pond is pumped into the grow-out pond and passing through a filter net

With stocking density of 25 per m² in the first and second runs and 40 per m² in the third, the total yield at DBS was about 15 tons of shrimp from three ponds with a total pond area of 2.6 ha. The average survival rate was 77%. The three runs yielded a total net profit of P1.7M. This could be a signal that the revival of shrimp industry has started.

AQD and BFAR have forged a joint mission to accelerate the transfer of aquaculture technologies nationwide. This mission is adopting and demonstrating AQD technologies using BFAR's demonstration and training facilities located in different strategic regions of the country. Hands-on training is already being implemented either at DBS or in private farms. Just recently, AQD joined BFAR's successful techno-caravan conducted in Regions 2, 5, 9, 10, 12 and 13. LandBank of the Philippines has expressed willingness to extend financial assistance to those who would like to venture into aquaculture using viable technologies recommended by AQD. A number of shrimp growers are already

availing of the technical assistance from AQD and financial assistance from LBP. [The increase in demand for shrimp feeds may also be an indication that the industry is indeed staging a comeback.]

With the success of the verification and demonstration projects implemented this year, TVES may have to expand to serve the numerous requests for technical assistance from various LGUs, POs, and NGOs. TVES is now being reorganized into a more comprehensive and responsive group to effectively and efficiently disseminate and transfer aquaculture technologies not only nationwide but in Southeast Asia as well.

On shrimp culture alone, Mr. Baliao said, there are plans to develop a production strategy using super-intensive stocking rates (about 60 pieces per m²) with partial harvests at different stages of the culture period to maximize pond productivity without negatively impacting the environment.

This new development in the shrimp industry, may encourage farmers to give shrimp another try -- that is, using a shorter culture period and producing smaller but healthier and very marketable shrimp. With AQD willing to provide technical assistance, the presence of a viable technology, high demand for small shrimp, and financial assistance from LBP, what more could shrimp growers ask? ###

We are developing a simplified, farmer-oriented selection procedure for tilapia broodstock

By **AS Frio**

In the Philippines, a tilapia farmer cannot always get enough broodstock to meet the requirement in his farm. What he usually uses are the commonly sold fingerlings, not the broodstock size, that he grows as broodstock to produce fry and fingerlings. Thus, he ends up with a few good broodstock and becomes largely dependent on an outside source.

In response to this problem, SEAFDEC/AQD scientists have developed a simplified selection procedure that a farmer can follow to produce his own good quality broodstock.

Dr. Zubaida Basiao, SEAFDEC/AQD scientist says that their selective breeding technique produces small but steady gains in tilapia growth in the long term. She reports that their research in Laguna Lake-raised tilapia showed a 3% gain in growth in the fish after one generation of offspring. On the other hand, their farmer-participatory research conducted in farmer's earthen ponds showed as much as 7-9% gain in growth after one generation. "Our computations indicate that a farmer can obtain as much as a significant 34% increase in income after five years with a 3% growth gain from two generations from selected broodstock. In addition, this selection procedure can be conducted easily with a few facilities and without disrupting production operations. Furthermore, a farmer would have more control over his choice of good quality spawners and reduce his cost for purchase of breeders. From the genetics point of view, we are promoting on-farm gene banking and a socio-economically sustaining genetic conservation of tilapia," Dr. Basiao points out.

Dr. Basiao avers that this simplified selection procedure can



Tilapia research at SEAFDEC/AQD's Binangonan Freshwater Station in the northern island of Luzon, the Philippines

be employed by a tilapia fish farmer, whether he buys breeders or fry to grow them into breeders. She advises however: "A farmer should get his breeders or fry from a reputable source like the Munoz, Nueva Ecija-based GIFT Foundation, the Bureau of Fisheries and Aquatic Resources National Tilapia Breeding Center, the Central Luzon State University, or from private tilapia hatcheries known for quality broodstock. He should also purchase

uniformly-sized fry, about 12 mm long and no longer than 14 mm."

The selective breeding technique

Dr. Basiao describes the procedure as follows: At the start, a farmer needs at least 150 male and 150 female tilapias to spawn. This number will ensure less inbreeding in the tilapias, resulting in a genetically healthy stock. The offspring of these original parents will then be grown and later used as the broodstock.

Then the farmer selects the fry that he will grow into spawners. As soon as the fry produced by the parent tilapias start swimming, he scoops the fry with an appropriate scoop net. He does this operation in a day or two and the collected fry can be pooled in a holding net from three to four days and fed with natural food. At the end of this holding period, the farmer passes the fry through an A-sized mesh net sorter. All fry that pass through the A-net sorter should be stocked in an appropriate nursery and grown as fingerlings. This almost uniformly sized group of fry will be grown into spawners. On the other hand, the culled fry may be grown as food fish for sale.

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After 6-8 weeks of rearing the fry or until they reach at least 40 mm long, the selection for length is done in two stages. At this time, each fingerling would be, on the average, about 39 millimeters long and would weigh about two grams. The first selection for length involves getting the average length of the fingerlings by measuring a random sample of 100-200 fingerlings. Then the farmer sets aside another random sample of fish that measures close to the mean length, say 200 fingerlings. This will be the unselected control group that can be used for testing the growth performance of the succeeding tilapia progenies.

The longest 50% of the fingerlings are then saved for further rearing. If the sexes of these selected fish can already be differentiated, the males and the females should be grown separately. If not, they are grown 4 weeks further or until they reach the size when the sexes can be determined.

The second stage of selection is conducted when all the fish are mature and are ready to spawn. Only the largest 10% of both the male and female are chosen as the select spawners. They should be stocked together in a separate breeding pond, cage or tank, taking special measure that no other fish except the select spawners are in the facility. They should then be allowed to mate among themselves randomly. These fish will now be the select broodstock that will be used to produce the first select generation of fish as well as the production fish for sale.

Determining response to selection

How does a farmer know that his selected broodstock perform well? Dr. Basiao suggests the following:

- The best way to do this is to compare the growth rate of the progenies of the selected broodstock with those of the unselected broodstock control group. This unselected broodstock comprises the other group earlier separated during the first selection for length.
- This control group should be reared under the same conditions as the select broodstock, that is, they should be provided the same husbandry and management schemes as those of the select group. This is the only way where a farmer can determine whether the growth rate of his fish is due to selective breeding.
- A farmer can also evaluate the fish response to his selective breeding process. He should grow together in the same environment the offspring of both the select broodstock and the unselected, or control fish. The fingerlings are matched in size and should be fin-clipped. The size of the fingerlings (20 from the selected group and 20 from the unselected) should be the same to within one millimeter and should be reared in at least three small cages. Then he takes length measurements of all the fish monthly until some data are ready for evaluation.
- While statistical analysis of data for significant differences is

not normally within the farmer's realm, he can already see some good trends in the fish growth rate from the raw averages of the fish length he had recorded.

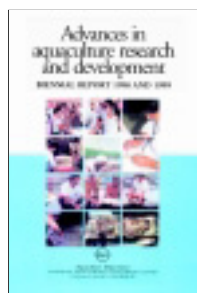
- This selective breeding program while simple and inexpensive requires facilities, labor, dedication and serious record keeping on the part of the farmer.

Plans for the future

According to Dr. Basiao, SEAFDEC/AQD expects to refine both the laboratory and on-farm procedure by conducting more farmer-participatory research. It also hopes to spread the selective breeding technique to more farmers by conducting short-term training courses. Lastly, SEAFDEC/AQD will expand or modify the use of this procedure to apply to other fish species. ###

Want to know more about SEAFDEC/AQD results?

- we have cloned the hormone that controls growth in milkfish and rabbitfish: a breakthrough in aquaculture biotechnology
- we are helping bring back the long lost Asian native catfish to Philippine waters
- we can now produce crablets for mudcrab aquaculture
- we are taking a closer look at probiotic products for shrimp culture
- we are developing a blueprint for sustainable aquaculture in mangrove areas
- we are refining abalone broodstock and hatchery technology
- we have completed the life cycle of red snapper and seahorse in captivity
- we are searching for cheaper substitutes for expensive larval feed



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WHAT DO YOU THINK OF THIS NEWSLETTER?

Dear Valued Reader:

We seek a little of your valuable time in answering our brief questionnaire. Our goal is to provide the relevant information that you need and in the form that is most useful to you. And we can only do this with your help and feedback.

Thank you very much!

MT CASTANOS

Editor, SEAFDEC Asian Aquaculture

STAMP

SEAFDEC Asian Aquaculture
Training and Information Division
SEAFDEC Aquaculture Department
Tigbauan, Iloilo 5021
The Philippines

QUESTIONNAIRE

1. What coverage of *SEAFDEC Asian Aquaculture (SAA)* most interests you?

	Very interesting	Somewhat interesting	Not interesting
AQD newsbriefs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AQD research publications / abstracts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Contributed papers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
People in aquaculture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aquafarm news / special feature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Of the Aquafarm news / special feature topics, what was the topic of most relevance to you?

	Very relevant	Somewhat relevant	Not relevant
<u>For 1999</u>			
Grouper culture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Marine ornamental fishes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Milkfish culture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tiger shrimp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bighead carp and ADSEA 99	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Local governments and aquaculture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<u>For 2000</u>			
Catfish culture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A beginner's guide	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Exotic aquaculture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The molluscs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fish marketing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aquaculture in Indonesia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. What topics would you like to see featured in SAA?

- ☐ Industry news, marketing news
- ☐ Technology news
- ☐ Progress in research-and-development
- ☐ Socioeconomic and policy issues
- ☐ About the environment, sustainability issues
- ☐ Others. Please specify _____

10. Any specific / general comments?

3. Do you usually find the articles in SAA ...

- ☐ Easy to read ☐ About average ☐ Too technical

4. What do you think of the design and layout of SAA?

- ☐ It helps me find my way around the magazine
☐ It is confusing
☐ I have no strong opinion

5. How did you learn of SAA?

- ☐ Recommendation from a friend, librarian, etc.
☐ From searching the SEAFDEC website
☐ From seeing a back issue
☐ Others. Please specify _____

6. How long have you subscribed? (SAA was first issued in 1978)

- ☐ less than a year ☐ 2-5 years ☐ More than 5 years

7. Did your issues arrived on time?

- ☐ Oftentimes ☐ Seldom ☐ Not at all

8. If SAA is made available online / in the internet, would you prefer getting your subscription this way?

- ☐ Yes, online is okay ☐ No, I prefer a hardcopy mailed to me

11. May we know a bit about you?

- What is your gender? ☐ Male ☐ Female
 Age? ☐ Below 30 ☐ 30-40 ☐ 40 or above

Which industry sector do you work on/for?

- ☐ Production
☐ Academe
☐ Extension
☐ Policy
☐ Others. Please specify _____

What aquaculture-related newsletter do you read in addition to SAA? _____

Please detach the questionnaire from the newsletter, tape the open edges, and mail to us. We'll give a free 1-year subscription to the first 50 replies sent before the end of March 2001.

Thank you for your time and support.

A batik postcard with a blue background. The central figure is a stylized, dark-colored person with a large, ornate headdress. On top of the headdress is a large fish with a green and white patterned body and red fins. The figure's face is dark with white, stylized eyes and a mouth. The figure wears a yellow and red necklace and a purple loincloth. The figure's arms are raised, and the hands are decorated with red and white patterns. The figure's legs are also decorated with red and white patterns. The text "Aquaculture in" is in pink and "INDONESIA" is in yellow, both in a bold, sans-serif font, centered over the figure's head.

Aquaculture in INDONESIA

Aquafarm news **SPECIAL FEATURE**

Message

AQD takes this opportunity to honor the entry of Indonesia to the SEAFDEC family with this issue of our newsletter, the *SEAFDEC Asian Aquaculture*. Indonesia's membership further strengthens SEAFDEC's presence in the region.

Notwithstanding Southeast Asia's diverse cultures and people, it is imperative in this age of globalization that nations must cooperate and collaborate in areas of mutual interest, be it in trade, finance, science and technology, or food production. Indonesia's family-based fishing and aquaculture practices will be of most interest to other SEAFDEC member countries; conversely, the technical know-how that AQD in particular has amassed on aquaculture can help the Indonesian farmers run their farms more efficiently and profitably.

AQD has developed technologies for breeding, feed development, health management, and grow-out culture of several marine, brackishwater, and freshwater species. We have also extensive technology demonstration and training programs that can further strengthen Indonesia's national centers of aquaculture.

Indonesia and other member-countries of SEAFDEC face similar problems in sustainable food production for our growing population. But with collective wisdom and consensus, we are hopeful that these problems are not insurmountable.

Welcome, Indonesia!

Rolando R. Platon, PhD
Chief, SEAFDEC/AQD



WELCOME TO OUR INDONESIA ISSUE!

Readers would find the country's fisheries profile, and the aquaculture systems that Indonesia is noted for like silvofisheries, rice-fish culture and shrimp culture.

We like the aquaculture systems in Indonesia because these are well-suited to small-scale operations of families. The idea of integrated farming operations also appealed inasmuch as farm resources would be better utilized. In the era of environmental responsibility, this would be the best use of limited resources.

We also hear the thoughts of an Indonesian fisheries official about his country's entry into SEAFDEC, and the benefits both will share. Last but not least are articles about some Filipinos working in the aquaculture industry in Indonesia and a website review on matters Indonesian.

Happy reading!

The fishery resources of Indonesia

By **E Gasataya**

Indonesia is rich in fishery resources. It can produce over 6 million tons of fish products in a given year, though at present, fish catch averages only about 2.3 million tons per year (45%).

The country ranks as one of the top ten fish producers in the world. Most of the catch comes from nearshore waters harvested by artisanal fishers despite government attempts to modernize the fishing industry. In addition, the country has aquaculture in brackish and freshwaters, including paddy fields.

Here are the fishery resources in Indonesia:

Demersal fishes

Demersal fisheries is known to be moderately exploited. The catch is about 2,068,000 tons while the maximum sustainable yield (MSY) is approximated at 1,033,800 tons per year. This view is based upon the swept area survey that calculates demersal fish resource based on fish captured by trawl.

The small pelagics

The pelagic small fish is defined as a school of small fish who lives near the surface of the sea. Among the species of this group (excluding tunas) are seeds (*Decaptures* spp.), Indian mackerel (*Rastrelliger* spp.), trevalies (*Selar* spp.), sardines (*Sardinella* spp.), wolf herring (*Chironcentrus* spp.), anchovies (*Stolephorus* spp.), hair tails (*Trichiurus* spp.). The MSY is approximated 50% of the resources or about 2.5 million tons per year within the area of 2,100,00 km².

Tunas

Tunas are well known as a highly migratory group which travels as far as 1,229 km or 2,276 miles. There are small and large tunas. Large tunas measure between 40 and 180 cm while small tunas range between 20 and 105 cm.

Large tuna species include yellowfin (*Thunnus albacares*), big eye (*abesus*), marlin (*T. allalunga*), south blue fin (*T. atlanticus* sp.), north blue fin (*T. thynnus*), black fin (*T. atlanticus* sp.), and sword fish (*Xiaphias* spp.).

Small tunas are skipjack (*Katsuwonus pelamis*) and the south-

INDONESIA the archipelago

17,508 islands (6,000 are inhabited)
81,000 km coastline
5.8 million km² sea area (70% of territory)
45.4 x 10⁵ ha of mangroves
2.3 million tons of fisheries products per year



A postcard from Indonesia by an unknown artist
courtesy of CR Lavilla Torres

ern little tunas (*Euthynnus affinis*, *E. alleteratus*, *E. lineatus*, *Auxis thazard*, *A. rochei*, *T. tonggol*).

MSY of large tunas is estimated at 178,368 tons per year while MSY of small tunas is estimated as 294,975 tons per year.

Shrimps and crustaceans

Penaeid shrimp is the major species produced, and is found in all coastal waters near estuaries, in waters 30-40 meters deep. The tiger shrimp (*Penaeus monodon* / *P. semisulcatus*) are comfortable in depths of 40-60 meters with clear water and muddy-sandy seabed. MSY of penaeid shrimp is 100,700 tons per year.

Spiny lobster is another popular species for export. It can be found in coral areas with sandy or crushed coral seabed. Common species found is *Panulirus homarus*. MSY of this is estimated as 4,487,700 tons per year.

Two crab species are also important fisheries commodities. One is mangrove crab or mud Crab (*Scylla serrata*) and the other is the ocean crab or swim crab

(*Pertunidae* spp.). The habitation of mangrove crab is entangled with mangrove distribution.

Coral fishes

Located in one of the most fertile ecosystem are the coral fishes. They are not fully utilized because of traditional catching technology and the difficulty in reaching the fishing areas. Species of this group include the yellow tail (*Caesio* spp.), the easiest to catch and market because of its high economic value.

At least 13 families of coral fishes have been found in Indonesian waters.

Molluscs

The most number of mollusc species are found in Indonesian waters. There are 100 species of clams (*Pelecypoda*), 1,500 species of snails (*Gastropoda*), 65 species of sea cucumbers (*Holothurioidae*) and two genus of cephalopods.

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Seaweeds

In the Siboga Expedition of the late 1800s to early 1900s, there have been 555 seaweed species collected from Indonesian waters. Of these, 55 species have been utilized traditionally for food or medicine.

There are two groups of red seaweeds (*Rhodophyceae*) being exploited. The first group -- agarophytes -- comprises of *Gracilaria*, *Gelidium* and *Gelidiopsis*. These species produce agar, a jelly product for food or other purposes.

The second group -- carrageenophytes -- consists of *Hypnea* and *Chondrus* which produce carrageenan, a polysaccharide agar-like product.

Other important seaweeds are the *Chlorophyceae* (i.e. *Caulerpa*) which is consumed as salad or pickled; *Sargassum* which can be processed to produce algin for agriculture and animal husbandry; and *Ulva* and *Entromorpha* which are used as natural fertilizers.

Aquaculture

Freshwater culture, brackishwater culture, marine cage culture, and public water cage culture have still an opportunity to be expanded and developed. However, only 30% of Indonesia's 4.29 million ha of mangroves can be developed for brackishwater culture. The aim is to maintain an ecological balance.

The species produced in brackishwater culture are tilapia (*Tilapia* spp.), milkfish (*Chanos chanos*), mullet (*Mugil* spp), giant sea perch (*Lates calcarifer*), and shrimp (*P. monodon*).

In freshwater culture, common species cultured are: carps (*Cyprinus carpio*), Java barb (*Puntius goniototus*), kissing gouramy (*Helostoma temminckii*), catfish (*Clarias batrachus*), giant catfish (*Pangasius pangasius*), snakeskin gouramy (*Trichogaster pectoralis*), giant frog (*Rana catesbiana*), eel (*Fluta alba*), freshwater giant prawn (*Macrobrachium rosenbergii*), river eel (*Anguilla* spp.), snake eel (*Hypothalmitic molitrix*), and grass carp (*Ctenopharyngodon idellus*).

Paddy fields are utilized for fish culture at the beginning of the planting season. In public waters -- lakes, rivers, dams, swamps -- fish can be cultured in floating and static cages.

The common species being exported by Indonesia are shrimps, tunas, and skipjack, froglegs, jelly fish, crabs and seaweeds. This shows that commodities exported are still limited to some particular species. Due to the decrease of oil prices, the government of Indonesia has encouraged fisheries exports to increase foreign earnings.

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Indonesia and SEAFDEC: some thoughts on the partnership



Mr. Anto Sunaryanto represented Indonesia in the recently concluded *Regionalization of the Code of Conduct for Responsible Fisheries (RCCRF)* held in Iloilo City, Philippines in November. Mr. Sunaryanto works with the Brackishwater Seed Division, Directorate General of Fisheries of the Ministry of Ocean and Fisheries in Jakarta, Indonesia.

Mr. Sunaryanto explains the fishery programs of Indonesia as it dovetails with the SEAFDEC agenda.

Q. Indonesia is the newest member of SEAFDEC. What specific fishery problems would you like addressed by SEAFDEC?

A. As ASEAN member country, Indonesia is facing similar problems with the other countries in the region. Among them, and these are the specific problems that would most likely be addressed by SEAFDEC, are:

- (1) **Fish breeding and genetics.** This is particularly needed for freshwater species (carps, tilapia) which have been practiced for a long time by traditional fish farmers. These farmers are recently facing problems of broodstock degradation. The problems may be caused by inbreeding and/or hybridization. We are now trying to trace the original varieties having specific superiority and distributing them to fishfarmers.
- (2) **Fish feed for mariculture.** Indonesia has a great potential for mariculture. Breeding of several species have been successfully achieved such as seabass (*Lates calcarifer*), groupers (*Epinephelus fuscoguttatus*, *Cromileptis altivelis*), but many others are still in their experimental stage to find an appropriate larval feed. For the species with successful breeding technologies, feed supply is also a problem of the grow-out phase since marine fish cage culture are still fed by uneaten, low economic value fish.

How does SEAFDEC fit into the national plans of Indonesia regarding its fisheries?

SEAFDEC may fit into the national plans of Indonesia by promoting a technical capacity building program in collaboration with aquaculture centers in the country. There are three national aquaculture centers, i.e., Freshwater

Aquaculture, Brackishwater Aquaculture, and Mariculture Development Centre. Besides, nine other centers serve at regional (sub-national) levels.

We have this fisheries program, PROTEKAN, that will generate dollar earnings within the next three years. With the vigilant environmental lobby groups, how will you reach your target without confronting these groups?

First, it should be noted that fisheries is not the only one responsible for environmental destruction (mangrove, coral reefs). For example, among the about 1 million hectare losses of mangrove forest during 1985, only 10% were converted to brackishwater ponds. Secondly, environmental protection and environment-friendly methods are observed in the implementation of the program. (Environment) groups have been invited to participate in the preparation and implementation of related programs.

With SEAFDEC's four departments each with different tasks (marine fisheries, aquaculture, postharvest, and resource development and management), which department is a top priority of Indonesia to help its fishery program?

If the priority should be given to one area, training in marine fisheries, etc, will be the most helpful. Indonesia lacks quality technical staff; this is a weakness of Indonesian development centers of fisheries.

Indonesia has also a lot to teach the SEAFDEC member countries too. Which do you think should be adopted by other countries (for example, Indonesia's indigenous technologies)?

Indonesian technologies that may be adapted by SEAFDEC Member Countries are: freshwater culture in rice fields ("minapadi"), culture-based management in lakes and reservoirs, milkfish (*Chanos chanos*) breeding, and shrimp (*Penaeus monodon*) culture technologies to cope with white spot virus disease.

What would you like to happen in terms of fisheries in the region?

Fisheries economic activities must be developed for small-scale levels in the region. Efforts should be addressed at utilizing fisheries resources to provide opportunities for livelihood. Fisheries, then, should be village-based, environment-friendly, and sustainable. Intensive guidance and extension are needed for maximum achievement.

-- By MB Surtida

Silvofisheries in Indonesia

By **MB Surtida**

The coastal and marine habitats of Indonesia has the most extensive mangrove forests in the world, seagrass beds and coral reefs which provide breeding and nursery grounds for a large number of fish species, crustaceans, bivalves, and endemic animals. Approximately 75% of Indonesia is marine and coastal waters including 3.1 million km² of territorial seas and 2.7 million km² of exclusive economic zone (EEZ).

With extensive resources, it is no wonder that the use of man-made ponds in rearing brackishwater animals has been practiced in Indonesia for hundreds of years. With this consideration, the Government of Indonesia adopted policies to promote the development of modern and traditional systems side by side through its pond forest or “tambak” areas. The “tambaks” covered an estimated 174,605 ha in 1977 and by 1993 it has risen to 268,743 ha.

Silvofisheries

Two alternatives to aquaculture pond development are silvofisheries and mariculture. Silvofisheries is a form of low input aquaculture integrating mangrove tree culture with brackishwater aquaculture. This approach to use and at the same time conserve mangroves maintains that while mangroves remain healthy, the economic benefits of brackishwater aquaculture can be realized. It is a labor intensive operation appropriate for individual or family operation and can be a viable alternative to brackishwater pond culture.

According to W. Fitzgerald Jr. of Oceania-Pacific Rim Consultant Services, there are two silvofisheries models, Type I, A, B and Type II, C, D (figure next page). The first model has 60-80% mangrove and 20-

40% pond canal culture water area. The next model (Type II), consists of mangroves outside the pond with similar mangrove to water ratio. The pond/mangrove forest (Type II) should be constructed with mangrove strips perpendicular to the coast so that the flow of surface runoff is allowed to be transported through the mangroves coastward. The advantages of the type II model are better management of the ponds, high potential production, and low production cost. Added to these, it avoids the potential toxic levels of tannin from the mangrove areas. It also allows for natural species diversity and flushing of the mangroves but the system is susceptible to development abuse such as encroachment on mangroves.

In the “empang parit” (also tambak tumpangsari) pond in Sinjai, South Sulawesi, the pond was within the planted mangrove. The pond is one hectare with two wooden gates. The screened gates are open all the time for the water level to fluctuate with the tides. The canal is 5 m wide, 1-0.7 m depth (below the central platform area). The central platform has an average water depth 20-30 cm. The ponds are stocked naturally with juveniles from incoming tides. The species are siganids, mullets,

milkfish, tilapia, shrimp, mangrove crab, and seabass. These are harvested by gill nets during low tide when the fish are concentrated in the perimeter canal.

Significant increases have been made in the volume and value of shrimp and fish exports. In an analysis by the Forest Management Division, “empang parit” in Cikiong and Cibuaya in West Java showed an annual net profit (ha/yr) of \$1,367 for mangrove crab, 1,347 for seabass, 2,601 for tilapia and chicken, 2,508 for milkfish and shrimp, and 1,322 for milkfish. In Bogor, West Java

SILVOFISHERIES

is a form of low input aquaculture integrating mangrove tree culture with brackishwater aquaculture.

THE POND FOREST

a.k.a. “**tambak tumpangsari**” is an example of silvofisheries

In connection with the reforestation program of the Indonesia State Forestry Corporation, the pond forest or “tambak tumpangsari” was applied to reforest the mangrove areas. Its purpose is to save the existing mangroves and to provide traditional fishery products. In the provinces of Riau, South Sumatra and South Sulawesi, large areas of mangroves have been converted to “tambak” shrimp ponds. But there is increasing pressure from international non-government environmental groups to stop destruction of mangroves specifically targetting shrimp culture. With this pressure, a balance to simultaneously address both development and conservation must be maintained. Social issues are closely linked to sustainable development while the economic need of the coastal population for jobs and income must be addressed. Aquaculture is one of the economic activities that has utilized the mangrove areas as a resource.

(9,047 ha), milkfish production was 1300 kg per ha per yr while shrimp was 400 kg per ha per yr. In Indramayu, also West Java (6421 ha), shrimp was 300 kg per ha per yr, while milkfish production was 500 kg per ha per yr. But over the past six years, the shrimp yield from “tambak” has decreased from a peak of 140,131 tons in 1991 to 79,494 tons in 1995. This has been believed to be related to increased levels of pollutants in the “tambak” areas. Full analysis of profit from silvofisheries has yet to be done.

With the success of the “empang parit,” two alternative designs are being planned. This design has low dike walls and no gates. Greater water exchange can be achieved, thus, minimizing water stagnation and the possibility of low oxygen levels that may result in mortality. The second design has no dikes and bamboo pens are placed within the mangrove. This is a lower cost method, eliminating investment on the construction of dikes, canals, and gates. It lessens the impact of aquaculture on the mangroves but it also diminishes the profit from raising fish and crustaceans in the canal areas.

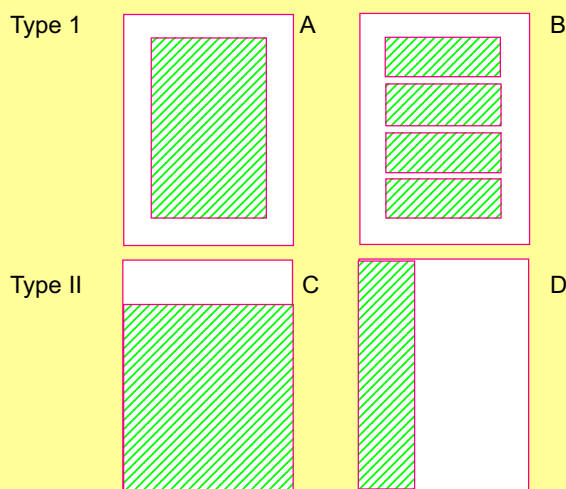
Existing programs for the utilization of mangrove areas

In the period since 1977, the fisheries sector proved to be the leading sector in economic growth.

With this, the fisheries Directorate launched a program PROTEKAN 2003 to boost foreign exchange earnings from US\$2 billion in 1997 to US\$ 10 billion in 2003 through aquaculture shrimp production. Brackishwater aquaculture would propel PROTEKAN 2003 to produce 700,000 tons of brackishwater shrimp (*Penaeus monodon*). To achieve this, 256,555 ha of brackishwater ponds would be operated intensively, and extensively develop 123,800 ha of new ponds. To prevent uncontrolled destruction of mangroves, promotion of silvofishery technology would be in full swing while replantation of mangrove trees would

SILVOFISHERIES MODELS

(green cross-hatched areas represent mangrove forest)



A postcard from Indonesia by an unknown artist
courtesy of CR Lavilla Torres

be undertaken in 27,427 ha of brackishwater areas.

Although development of marine aquaculture is a huge potential, it is still in its infant stages. There are at least 10 million hectares of marine area considered as potentials, with 3.5 million ha for fish, 5 million ha for pearl oyster, 1.85 million ha for seaweeds and 700,000 ha for mollusc culture. At the present time, marine aquaculture is into growing natural caught fish into bigger size because seed production has not been developed, including nutrition and feed technology.

Indonesia’s Law No. 5 of 1990 adopts the concepts of sustainable use and ecosystem integrity. It provides the basis for the operation of protected natural areas, coastal zone such as mangrove rehabilitation while Law 24 of 1992, integrates management functions in the context of land use management. This law sees to it that any implementation of projects conforms to the spatial plan, especially in efforts to improve mangrove areas in terms of sustainable aquaculture use. But even with detailed legislation, effective law enforcement can be undermined by social and economic factors such as low wages of forest guards.

Recommended national and regional approaches to silvofisheries

For planning purposes, Resource Management Areas (RMA) have been identified to manage coastal resources. The RMAs contain differ-

ent combinations of different combinations of resource-use options. RMAs in the intertidal zones focus on options in managing “tambak” areas. For a management plan to be effective, it is necessary that local authorities clarify ownership status in mangrove and the whole coastal zone.

For mangroves, social and economic sciences and management aspects must be included in any ecosystem research. “Tambak” farmer communities should be part of an overall management strategy for the mangrove habitat.

Rice-fish culture systems

By **AP Surtida**

Rice-fish culture has a long history in Indonesia, beginning in 9th century in West Java. Today, it is practiced in 17 out of 27 provinces in Indonesia. Rice-fish culture has spread to about 94,309 ha with 69% in Java, 15% in Sumatra, 6% in Sulawesi, and 10% at Nusa and Tenggara islands (Supriatna 1998).

Its distinct advantages are: (1) it allows farmers to maximize farm resources and therefore diversify harvest that leads to additional income; and, (2) it provides fish protein for land-locked areas otherwise deprived of fish from marine sources.

The rice field offers a special environment for raising fish if farmers use fertilizer properly. The ricefield has a high level of fertility owing to the rates of mineral elements, which result in higher production of rice. It is also rich in flora (algae, phytoplankton) and fauna (insect larvae, worm, zooplankton) which can serve as fish food.

Conversely, fish are beneficial to rice plants because they help provide a better growing environment of rice by controlling weeds and species of insect pests.

There are two types of rice-fish culture in Indonesia: (1) simultaneous rice-fish culture at the same field at the same time and (2) crop rotation wherein rice and fish are alternately raised as crops in the same rice field. Generally, the rice-fish technology was developed by farmers themselves.

The widely practical rice-fish culture in irrigated areas of West Java are: *minapadi*, *penyelang* and fish *palawija*. In the coastal areas of East Java, there is a special system called *sawak tambak* (de la Cruz 2000).

Most of the fish pro-



A "primitive passion card" hand-made by Z. Sunarya in Bali, 1991
courtesy of CR Lavilla Torres

duced from ricefields are used mainly for restocking in growout systems such as: floating net, bamboo cages, running water (concrete tanks) and irrigation canal systems.

Rice varieties such as the IR64 (wet season) and *ciliwung* (dry season) which are proven to yield high with fish are planted.

Planting distance of rice plants is 20 x 20 cm, 22 x 22 cm or 25 x 25 cm. West Java farmers use the following fertilizers (in kg per ha): urea, 200; triple superphosphate, 100; potassium chloride, 100; and ammonium sulfate, 50.

At the tillering stage of rice, water is kept low and is gradually raised to 10-15 cm throughout the rice growth.

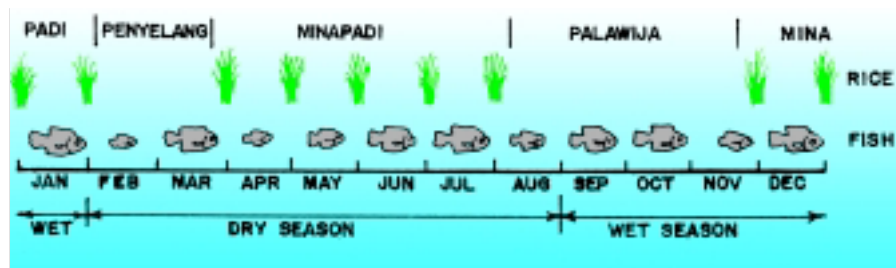
Common carp (*Cyprinus carpio*, 15-25 g) are stocked at 2,500-3,000 per ha 7-10 days after rice planting. A center or a

cross trench occupies about 2% of the total

rice field area. Harvesting is done by draining the field slowly after a culture period of 40-60 days. By this time, the fish attain 50-100 g, the size desired for stocking cages and running water culture systems.

In the *minapadi* system, rice and fish are simultaneously raised in the same area. A trench refuge (0.5m wide and 0.3-0.4 m deep) is used. There is a variation called *payaman* method. The difference is that the rice-fish field is connected to a pond refuge instead of a trench.

The *penyelang* system is the culture of fish in between the first and second rice crops. Fish culture is shorter than the *palawija* system. A portion of the rice field with rice



A schedule for rice-fish farming in Indonesia (redrawn from de la Cruz 2000)

stubbles is immediately stocked with common carp, while the remaining portion is prepared for the dry season's crop.

Stocking size ranges from 5-8 or 8-12 cm or 15-25 g, depending on availability. Stocking rate is 2,000-4,000 fish per ha. Water depth is 10-20 cm. Fish are harvested after 30-40 days. The short period may not produce the desired size for grow-out in cages and running water systems, especially if stocked small. However, grow-out operators also buy small fish seeds if supply is scarce. The unsold fish are re-stocked in the following dry season crop.

The *palawija ikan* system is immediately done after the harvest of the dry season rice crop.

Dikes are raised to contain water depth of 30-40 cm. The stocking rate and size vary. In West Java, common carp of size 3-5 or 5-8 cm are stocked at 5,000 per ha without feeding. In North Sumatra, consumption size is produced in the *palawija* system. Stocked sizes are 30-50g or 50-100 g at the rate of 1,000-1,500 (no feeding); and 1,500-3,000 (with supplemental feeding). Supplemental feeds are rice bran, chopped cassava, corn kernel soaked in water, poultry feed, kitchen refuse and others. Harvesting the fish is done by draining the field.

The above systems are combined into sequential cropping patterns in a year such as:

- *Minapadi* (rice-fish), *penyelang* (fish only), *minapadi* (rice-fish), then *palawija* (fish only)
- Rice, *penyelang*, then rice *palawija*
- Rice, rice, then *palawija*
- Rice-fish-duck, fish-duck, rice-fish-duck, then fish-duck

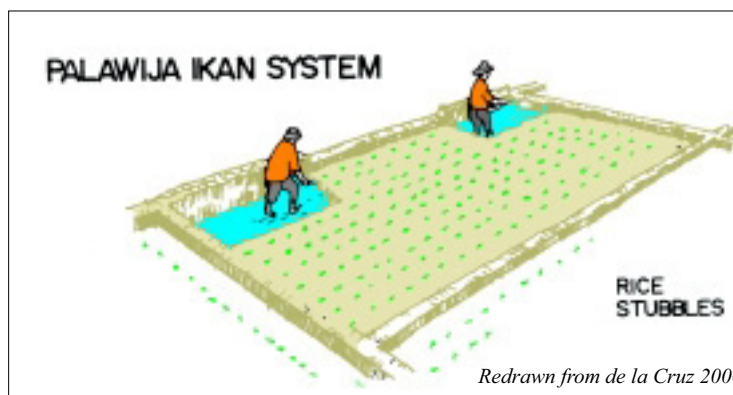


Redrawn from de la Cruz 2000

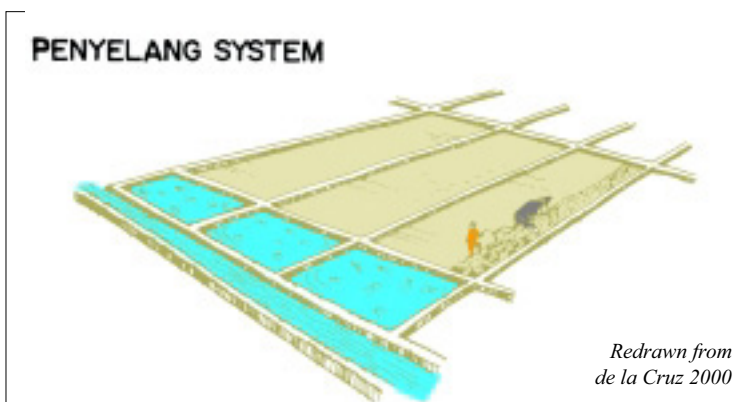
are kept when necessary. Ducks can make the system most profitable. The year-round supply of eggs provides monthly income to the farmer. Without ducks, the first pattern (*minapadi-penyelang-minapadi-palawija*) is the most profitable.

Fish stocking and production data

System	Stocking size	Rate per ha	production (kg per ha)	Culture period
Minapadi	15-25 g	2,500-3,000	100-200	60
Penyelang	15-25 g	2,500-3,000	70-100	30-40
Palawija	5-8 cm	5,000	200-300	60
	30-50 cm	1,000-3,000	300-800	60-70
	50-100 cm			



Redrawn from de la Cruz 2000



Redrawn from de la Cruz 2000

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A glimpse at shrimp culture in Indonesia

By **AP Surtida**

Just like the Philippines, shrimps in Indonesia were by-products of milkfish culture in traditional brackishwater ponds. It became the main product of aquaculture ponds when appropriate culture technology, including mass production of seeds, became available in the '80s. It was also the result of a national program of shrimp culture development in anticipation of the trawl ban in 1980 which would reduce marine shrimp production (Nurdjana 1997).

In 1998, foreign exchange earnings from shrimp increased by 11%, from US\$1.35 billion to 1.5 billion according to Johannes Kitono, chairman of the Association of Indonesian Shrimp Feedmeal Producers (Fish Farming International 1999).

Kitono added that the US market has the greatest potential, and that Indonesia's shrimp export rose by 19% in 1998 to 15,285 tons. Thailand has been the biggest shrimp exporter to the US in the past three years, while Indonesia ranks fifth, said Kitono.

Kitono further added that the government needs the support of all producers to meet a target of one million tons of shrimp (with exports of 600,000 tons) by 2003.

There are three factors affecting the Indonesian shrimp culture industry: (1) biological production capacity (2) environmental carrying capacity and (3) economic conditions.

Wisened from the follies of past experiences, the Government of Indonesia decided to develop a sustainable shrimp culture industry in order to achieve optimum sustainable income, optimum use of natural resources and sustainable environment. The policies to develop the industry include: (1) adjustment of the production intensities of shrimp culture in the Java Island to meet the conditions of sustainable resources use and sustainable production, and (2) extension of shrimp culture area into potential areas outside of Java Island. Total shrimp culture area that will be developed is about 250,000 hectares (Nurdjana 1997).



Farmed shrimp continues to be Indonesia's top seafood export. PROTEKAN 2003, a government program, aims to increase foreign exchange earnings -- estimated to be US\$6.7 billion -- mainly from farmed shrimp

Pond area, species and production:

Total area of brackishwater ponds

1986	241,000
1995	333,000*

*managed by 126 thousand units of households

Shrimp species harvested from brackishwater ponds

Black tiger shrimp *Penaeus monodon***
White shrimp *P. indicus***
Banana prawn *P. merguensis*

**main cultured species

Total shrimp production harvested from ponds (in thousand tons)

1986	43
1992	144
1994	137
1995	149

Aquaculture by the numbers

233 - the number of hatcheries supporting the shrimp industry in 1995, with total production capacity of 5 billion fry a year

45 - the number of feed factories (1995) producing 526,00 tons of feed per year

25% - rate of increase per annum in the production of cultured tiger shrimp between 1986-1995

11% - rate of increase per annum for banana prawn for the same period above

8.9% - rate of increase per annum for *Metapenaeus* spp for the same period above

89,300 tons - production of the tiger shrimp in 1992 from 15,400 tons in 1986

83,200 tons - production decline in 1994

25% - rate of increase in tiger shrimp production due to intensification of existing ponds. It was greater than the increase in total pond area (3.7 per year)

Shrimp export, 1986-1995

	Volume (x 10 ³ tons)	Value (US\$ x 10 ⁵)
1986	36.1	285
1990	94.0	690
1992	100.5	765
1995	94.5	1037

Estimation of employment benefits from shrimp culture

Production intensity	Total area of ponds (10 ³ ha)	No. of workers (people per ha)	Total workers	Estimated wages (Rp x 10 ⁶ per year)
Intensive	27.3	3	81,900	209,255
Semi-intensive	37.1	2	74,200	135,415
Extensive	262.5	0.5	131,254	143,723
Total	326.9		287,354	488,393

A shrimp farm-level survey was conducted in the provinces of east Java and South Sulawesi after the crop failure in 1994. The crop failure was caused mainly by disease outbreaks (i.e., degradation of the environment) and was exacerbated by drought. The respondents' conclusions are as follows (Aquaculture Asia 1998):

- Intensive shrimp culture should be controlled based on carrying capacity of areas
- Controlled use of drugs and chemicals to avoid deterioration of water quality
- Observance of ministry regulation that mangroves areas should be maintained at 200 meters from seashore or 50 meters from riverbank in brackishwater farming

The national action plan for sustainable aquaculture, particularly in shrimp farming was formulated as follows:

- The government encourages private investors in shrimp farming in the areas outside Java Island.
- Semi-intensive culture is encouraged particularly in the densely cultured areas, by reducing stocking density and applying less chemicals.
- Recommendation of better shrimp culture management particularly in seed production, water management and post harvest.

Also, in shrimp farming systems, farmers in the same area are encouraged to cooperate more closely, particularly in the use of water supply and discharge of used water to drainage canals. Synchronizing the timing of change of water at high tide and discharge at low-tide is also being encouraged.

The government has since extended the following assistance to shrimp farmers:

- construction/rehabilitation of migration canals in brackishwater pond areas.
- advice on site selection, pond management and post-harvest through extension services.
- seed production technology
- disease prevention in grow-out ponds

A loan from the Asian Development Bank (ADB) has been obtained for the private sector under the Second Brackishwater Aquaculture Development Project to develop shrimp culture outside Java Islands.

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Filipino expats in Indonesia's shrimp industry

By **RIY Adan**

Filipinos, in one way or another, have contributed to the development of aquaculture in Indonesia. This is no surprise because one of the biggest and the best aquaculture training centers this side of the Pacific is found in the Philippines, and we refer to SEAFDEC/AQD. And who else would lead the way but six former SEAFDEC/AQD employees who have worked in some of the biggest shrimp farms in the world? Read on and find out how they fared in their Indonesian sojourn.

Fernando Suñaz

To date, Fernando Suñaz has been involved in aquaculture for more than 20 years. Before his stint in Indonesia, he worked as a researcher at the Mindanao State University (MSU) and at SEAFDEC/AQD; later on engaging in shrimp hatchery management and consultancy work in the Philippines.

With the downfall of the shrimp industry due to diseases in the early 90s, Suñaz worked for USAID and FAO abroad as short-term consultant. Then in 1993, he accepted work in Lampung, Sumatra for PT Dipasena – one of the largest shrimp farms in the world with total land area of 16,000 ha, consisting of about 4,500 shrimp ponds after completion.

“With the collapse of the industry, I decided to make use of my expertise in Indonesia, where the shrimp industry was then in its infancy. Moreover, the pay was generally better there and I could use the exposure,” he reasoned out.

“I started as a Production Manager, handling about 200 ponds. By 1995, I took over as a manager of the Research and Development Department, the main responsibilities of which were to do both basic and field researches that were directly relevant to improving shrimp production in ponds. Priorities were usually set after consultations with the production people and approval by the General Manager. We also monitored the quality of all pond inputs including shrimp fry as well as environmental impacts of our production activities, among others.”

Suñaz pointed out one personal disadvantage: being away from the family. But this, he said, was also an advantage at work. “One can really concentrate. The pressure was very heavy since we were considered experts/consultants; thus, we really had to prove our technical capabilities. We were there not to work and stay forever; but to teach and transfer to the locals whatever technical know-how we have gained, so that later on they can take over and manage the operations by themselves.”

After six years in Indonesia, he felt he has contributed enough. He is back in the country and is still very active in his private capacity as shrimp aquaculturist.

Leonardo Tiro Jr.

“It is now 25 years since I’ve been involved in various aquaculture projects in the Philippines, Thailand and Indonesia; 15 years of that was spent in Indonesia,” said Leonardo Tiro Jr.

Following his stint in MSU and SEAFDEC, he worked as a private consultant specializing in all aspects of private sector



Fernando Suñaz



Leonardo Tiro

aquaculture development. After a brief job as a hatchery operator and at the same time as part-time consultant of aquatic farms, he was given an opportunity to be a part of a team in Indonesia to implement the US\$56 million ADB-funded project to establish five hatcheries in various provinces in Indonesia and major canal rehabilitation for shrimp farming in northern Java. This was followed with assignments in several Indonesian aquaculture companies where he served, among others, as hatchery manager of PT Windu Nurimba Utama, general manager and later on promoted as company head of PT Birulaut Khatulistiwa, Dipasena Shrimp Hatchery Center, and vice-president of the hatchery division of PT Centralpertiwi Bratasena.

“Working in Indonesia or anywhere in the world is easy, as long as you have the respect of the local counterpart and the staff. My experience there was an eye opener, especially in managing people.”

“I consider Indonesia as a sleeping giant of aquaculture. The country has vast areas for aquaculture projects, cheap and trainable labor force, excellent water quality and well-placed infrastructure for the industry,” he continued.

At present Tiro is the managing director of the Super Shrimp of Asia Pte Ltd. in Singapore, where he is tasked to start-up a

regional office headquarter and overall operation and strategy of the business.

"I am still residing in Indonesia with my whole family. I have aquaculture consulting and hatchery business operations with Indonesian partners. Besides a few businesses, I am now promoting the culture of SPF/SPR white shrimp in the region as another option besides tiger shrimp."

Leo Cababasay

"Working in Indonesia was very self-satisfying considering that as a manager, my plans and ideas were done with minimal red tape," said Leo Cababasay.

He worked in Indonesia for almost 9 years. He started as

of modern technology leading to higher production of aquaculture products.

"Aquaculture in Indonesia is still in its infancy, so I would say that there are still a lot of opportunities for Filipino aquaculturist to work there."

Pastor L. Torres Jr.

"My decision to work in Indonesia resulted from a convergence of two events – the shrimp industry in the country hitting bottom and two employment offers pending then: one was in the Philippines and the other in Indonesia. I accepted the latter offer, not only because of the adventure in working in a foreign country, but because the work is a direct continuation of my work at that



Leo Cababasay



Pastor Torres Jr.

planning and control manager, tasked with planning and implementing the annual production schedule of the farm. In 1994, he was promoted as senior manager for pond operations support, handling more than 2,000 personnel tasked with the logistics, engineering, and transportation aspects directly related to shrimp production.

"PT Dipasena is a private company and expatriates are regarded as experts in their field of work so much so that most of what we envision were implemented. But we have to make sure that we produce or else we get fired," he explained.

Cababasay noted that Filipinos had greatly contributed to the development of aquaculture there through the introduction



Edgardo Reyes



Precilla Subosa

time – shrimp culture and engineering," explained Pastor Torres Jr., who has been involved in aquaculture engineering for 25 years to date.

The company that he worked with for almost five years (the PT Wachyuni Mandira) was involved on a large-scale integrated shrimp business – pond grow out, hatchery, feed manufacture, and export processing.

"My specific work was to conduct studies for the development of the pond system. This includes: pond design (geometry and pond facilities), design of the water system (gates, pumping stations, and canals for water intake, draining, settling, and mixing), life support and logistics system. Since the pond system is an entirely different configuration from what was existing then, I also had to run test-cultures myself."

On the other hand, Torres noted that Filipino and Indonesian cultures have a number of similarities, however, there are distinct differences which shows in the workplace. In general, Indonesians conform and follow established authority. While this makes it easier to perform your current work, the capacity and potential of the Indonesian human resource appears not fully optimized.

☞ NEXT PAGE

"Here in the Philippines, our society is more open. Thus, decisions in the workplace are generally arrived at using participative procedures," he said.

He also added that the English-language proficiency of Filipinos is many times more than that of the Indonesians. Thus, Filipinos have an easy access to new technologies. It is in this context that Filipinos fit the role as sources of new knowledge and skills.

"Indonesia is a huge country and the aquaculture potential is as huge. Even if the shrimp technology is not very advanced, by the sheer size of the shrimp industry, its absolute production is bound to be big. Shrimp aquaculture will continue to expand. Filipinos are popular choice for expatriate manpower because they easily adapt to the Indonesian work environment. I think, Filipino specialists or senior aquaculturists should have no difficulty getting a job in Indonesia," Torres concluded.

Edgardo Reyes

In his 24 years in aquaculture, Edgardo Reyes spent four years of it in Indonesia – particularly in PT Dipasena Citra Darmaja and PT Birulaut Khatulestewa, Bandar Lampung.

"They were looking for an aquaculturist with background in doing research work and I was seeking employment. The company that hired me is the biggest integrated shrimp aquaculture project in the world and joining them will give me a good exposure."

In Indonesia, Reyes was involved in research, technology development and verification. He provided technical assistance to the farmer-grower/beneficiary through demonstration and actual run. He also conducted several seminars and trainings to develop and update the technical capability and skills of the research and technical staff.

But before his stint there, Reyes was involved in SEAFDEC's training and extension programs for eight years. After which, he served as a consultant-technician to various shrimp hatchery and grow-out projects in the Philippines. He then went to India for three years where he worked as hatchery manager and grow-out consultant.

With his extensive experience in aquaculture, coupled with the Indonesians high regards for Filipinos, it was not difficult for him to train the locals.

According to Reyes, some of the shrimp aquaculture projects there are big and integrated; these do not exist in the Philippines or elsewhere. They are community-based and involved a vast area. The projects have also the latest technology and equipment.

"The work there is gratifying and rewarding. Filipinos working there were able to improve their social status and technical skills. The experience is not available anywhere and could be an advantage when the trend for aquaculture development becomes massive and community-base."

To end, Reyes is hoping that the people he has trained will be able to carry on and improve the coming generations of technical manpower for the Indonesian aquaculture.

Precilla Subosa

"After serving SEAFDEC for 22 years, I decided to work in Indonesia to share and widen my experience in aquaculture, but specifically for self-improvement," so said Precilla Subosa, who served as a research specialist for 3 years at Telukbetung, Bandar, Lampung, Indonesia.

She managed the soil feed and water quality laboratory of the R&D Department. She also conducted several researches on environmental quality, feeds, pond water and soil management, natural food and fertilizer, and other pond inputs both in lab and pond scale.

"My work required too much self-sacrificing effort to achieve the goal of the Department. But I am grateful that in one way or another, I took part in developing and establishing the feed, soil, and water quality monitoring scheme for an intensive shrimp farm there."

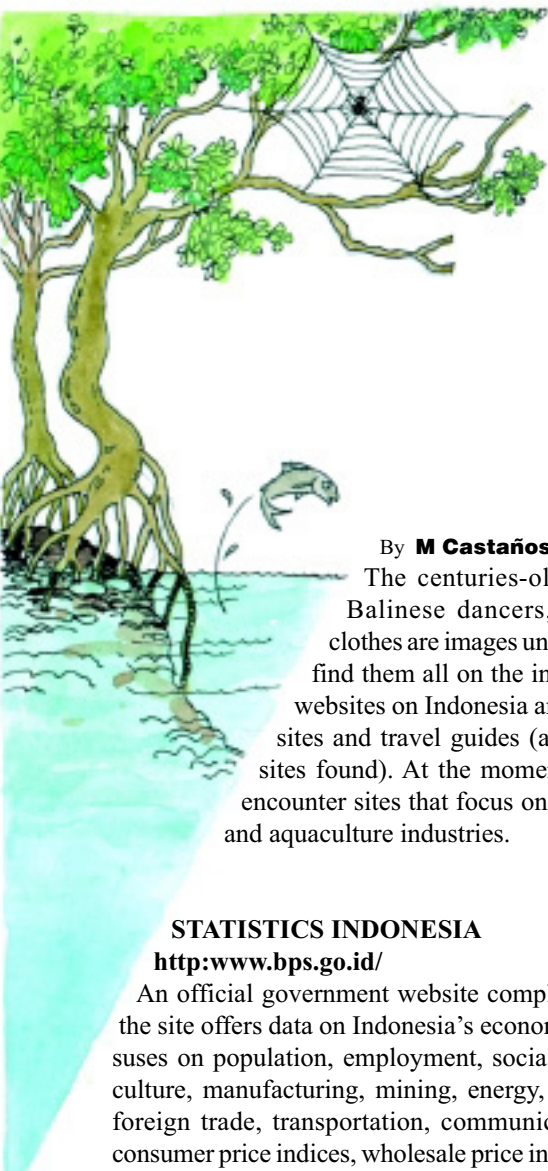
Having devoted 26 years of her life to aquaculture, Subosa is now concentrating in both social and economic affairs of her family. ###

SILVOFISHERIES ... FROM PAGE 21

A licensing program of all commercial activities based within mangrove areas should be established. This would serve as a sort of control that balances environmental, developmental, and social needs. This program requires diligent and equitable enforcement because without them, there is danger of uncontrolled development and regulatory abuse.

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On the web: Indonesia

By **M Castaños**

The centuries-old Java man, graceful Balinese dancers, one-of-a-kind *batik* clothes are images unique to Indonesia. We'll find them all on the internet considering that websites on Indonesia are dominated by tourist sites and travel guides (about 35% of over 100 sites found). At the moment, it would be rare to encounter sites that focus on the country's fisheries and aquaculture industries.

STATISTICS INDONESIA

<http://www.bps.go.id/>

An official government website complete with coat-of-arms, the site offers data on Indonesia's economic indicators and censuses on population, employment, social welfare, wages, agriculture, manufacturing, mining, energy, construction, tourism, foreign trade, transportation, communication, public finance, consumer price indices, wholesale price indices, consumption and expenditure, and national and regional account.

The website is a goldmine of figures so-to-speak. Data that were not posted can be requested.

Fishery statistics can be accessed through the Agriculture button. We pulled out two of the six tables that would be of most interest to aquaculturists:

Fish production in Indonesia, by sector, 1995-1999 (thousand tons)
(Source: Directorate General of Fishery)

Year	Total	Marine fishery	Open water	Brackish water pond	Fresh-water pond	Cage culture	Paddy field
1995	4,263.6	3,292.9	329.7	361.2	162.2	39.9	77.7
1996	4,452.3	3,383.5	335.7	404.3	182.9	44.6	101.2
1997	4,549.9	3,560.9	338.9	291.0	188.4	58.9	111.8
1998	4,764.6	3,616.1	344.5	448.5	199.2	46.8	109.5
1999*	5,112.4	3,672.2	350.2	691.2	210.6	74.1	114.1

*preliminary figures

Number of fish culture households, area under culture, and production in Indonesia, 1999* (Source: Directorate General of Fishery)

Type of culture	Households	Area (ha)	Production (tons)
Brackishwater pond	155,831	373,406	691,200
Freshwater pond	723,438	76,468	210,600
Cage	38,822	132	74,100
Paddy field	219,254	157,625	114,100
Total	1,137,345	607,631	1,090,000

*preliminary figures

A PRIVATE COMPANY

<http://aquatic.co.id/>

Aquatic Indonesia calls itself an integrated aquaculture company, and has office address at No. 4 Jalan Cidangi, Bogor. They sell tropical fishes, aquatic plants, shrimps and soft green turtle, shrimp and fish feeds, Indonesian beetle, and zeolite. The site has a search feature.

PETER LOUD's MAPS OF INDONESIA

<http://users.powernet.co.uk/mkmarina/>

A collection of beautiful, colored maps are found on this site. The front page is a map of Indonesia where browsers are invited to click on to find more detailed maps (like the dive map below).



<http://users.powernet.co.uk/ukmarina/baranglo.gif>

NEXT
PAGE

dear SAA readers



the best of luck in the new millennium!

Hope you enjoy reading!
ERIC

Click! Click!
Romy

Happy Holidays
to all!

Lydia

Enjoy reading!
-Egan-

Stay tuned!
suggie

Look in these comments
Marilyn

Fish be with you
always!
sio

Happy reading!
Ing

yep, that's us! Mila

from the SAA editorial staff

WEBSITES ... FROM PAGE 29

The site owner, Peter Loud, is a GIS/MIS specialist who had been "working in The Maldives, working with UNHCR in Timor, travelling around South East Asia, and sailing across the Indian Ocean."

RESOURCE UTILIZATION

<http://www.earthisland.org/map/ltfrn.htm#asia>

This site of the Mangrove Action Project (MAP) contains articles on earth resources, resource management, and other news updates. For Indonesia at the time of the search, we found this gem of wisdom -- Professor Boedhihartono's "How societal thinking shapes attitudes to resource exploitation in Indonesia." The professor works for the Department of Anthropology at the University of Indonesia.

The best way to get updates from sites such as MAP's is to enrol in their mailing list. Write to: <moderator@csiwisepractices.org>

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FISHLINK 2000

29-31 May 2001

Sarabia Manor Hotel

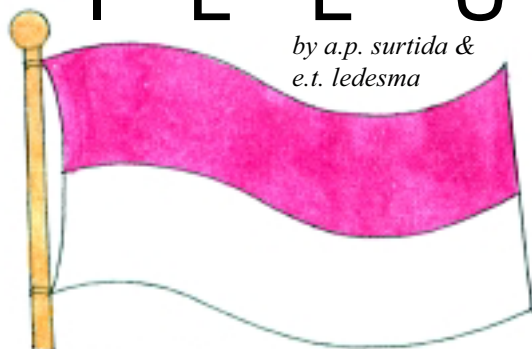
Iloilo City, Philippines

The seminar will tackle new developments in the rapidly growing field of fish production in the Philippines. Various experts will discuss the aquaculture industry's profile, trends and economics; advances in milkfish, grouper-seabass-snapper, mudcrab, shrimp, high-saline tilapia, African catfish, native catfish and the seaweed *Kappaphycus*; emerging aquaculture technologies like abalone, ornamental fishes, reef and pelagic fishes, white lip oyster; postharvest technology including ethnic/emerging value-added products.

For more information, contact: U.P. Aquaculture Society, Inc. Email - aquasoc@yahoo.com; tel/fax 63 (33) 321 2149 or 511 8951

AQUACULTURE ILLUSTRATED

by a.p. surtida &
e.t. ledesma



SOME BASIC FACTS ABOUT INDONESIA

INDONESIA HAS A LAND AREA OF 1,826,440 Km². IT COMPRISES OVER 17,508 ISLANDS, OF WHICH 6,000 ARE INHABITED. THE LENGTH OF ITS COASTLINE IS 54,716 Km. IT IS THE LARGEST ARCHIPELAGO - STRETCHING ALMOST 5,000 Km - IN ASIA.



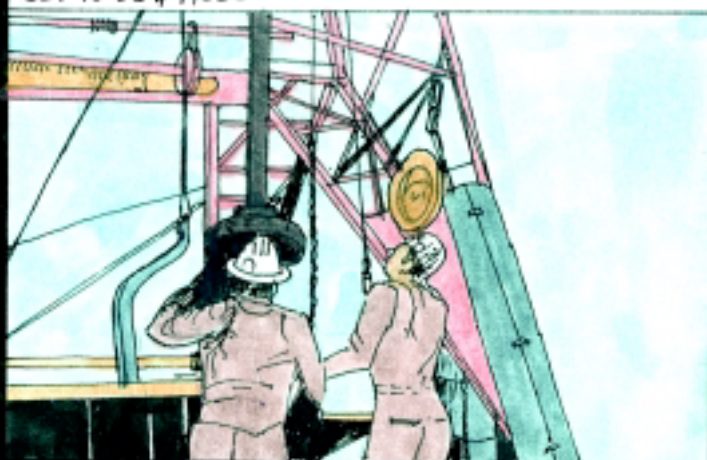
INDONESIA IS THE 4th POPULOUS NATION ON EARTH. ITS POPULATION IS 216,108,345.



THE ETHNIC GROUPS ARE JAVANESE (45%), SUNDANESE (14%), MADURESE (8%) AND OTHERS (8%). CHIEF RELIGIONS ARE: ISLAM (87%) AND PROTESTANT (6%). BAHASA INDONESIA IS THE OFFICIAL LANGUAGE.



ITS MAIN EXPORTS ARE: OIL, GAS, TIMBER, TEXTILE AND SEAFOODS. GDP (1997) IS US\$960 BILLION, PER CAPITA GDP IS US\$4,600.



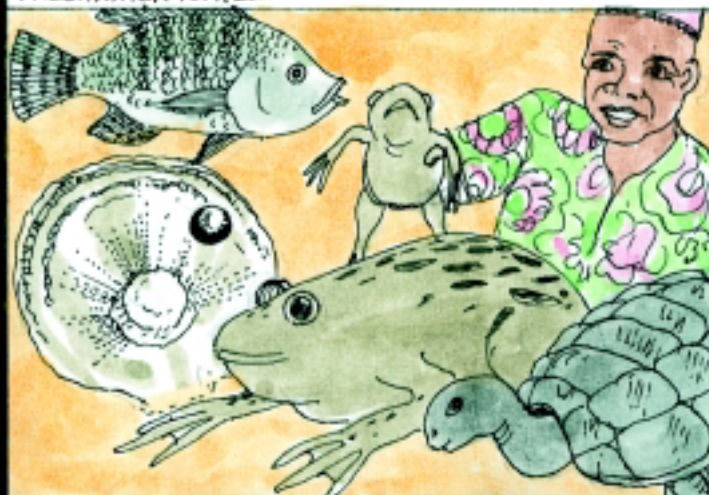
INDONESIA'S FISHCATCH (1997) IS 3.65 MILLION METRIC TONS. IT ALSO RANKS THIRD IN THE WORLD'S FARMED SHRIMP PRODUCTION.

	PERCENT OF PRODUCTION	HEADS ON PRODUCTION (METRIC TONS)	HECTARES IN PRODUCTION	NO. OF FARMS
THAILAND	31	220,000	90,000	20,000
ECUADOR	14	100,000	125,000	1,900
INDONESIA	11	80,000	300,000	4,000
CHINA	10	70,000	13,000	6,000
INDIA	8	60,000	80,000	5,000

THE FISHERIES SECTOR HAS PROVED TO BE THE LEADING SECTOR IN INDONESIA'S ECONOMIC GROWTH. IT HAS A POSITIVE GROWTH OF 3% PER YEAR. REALIZING THIS, THE GOVERNMENT HAS LAUNCHED **PROTEKAN 2003**.



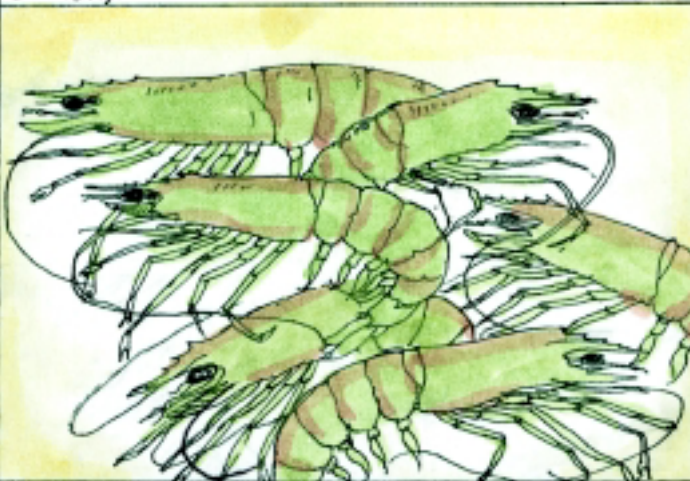
THE OTHERS WILL BE COMING FROM CAPTIVE FISHERIES. MARICULTURE OF SEAGRASS, SEABASS, GROUPERS AND PEARL; FRESHWATER CULTURE OF NILE TILAPIA, BULLFROG AND FRESHWATER TURTLE.



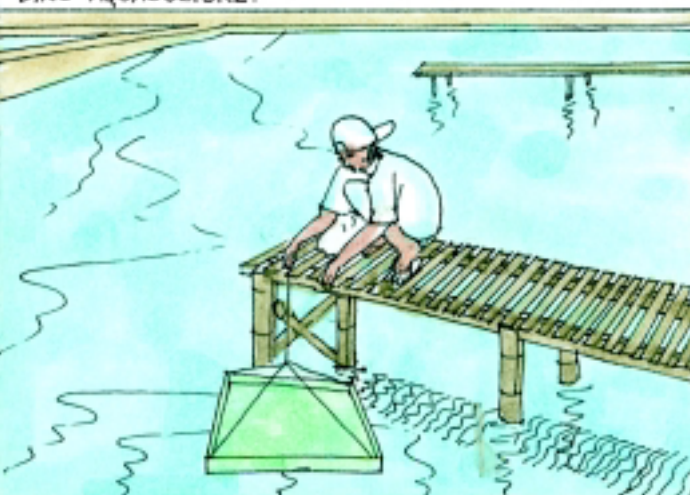
THE DIRECTORATE GENERAL OF FISHERIES HAS THREE (3) NATIONAL CENTERS FOR THE DEVELOPMENT OF AQUACULTURE TECHNOLOGY NAMELY - THE FRESHWATER CENTER IN SUKABUMI, WEST JAVA; BRACKISHWATER CENTER, IN JEPARA, CENTRAL JAVA AND THE SEAFARMING CENTER IN BANDAR LAMPUNG, LAMPUNG.



PROTEKAN 2003 IS A FISHERIES PROGRAM AIMED TO INCREASE FOREIGN EXCHANGE EARNINGS FROM US\$ 2 BILLION IN 1997 TO US\$ 10 BILLION IN 2003. MOST OF THE VALUE IS EXPECTED TO BE EARNED FROM FARMED SHRIMP (US\$ 6.79 BILLION).



THE DIRECTORATE GENERAL OF FISHERIES, UNDER THE MINISTRY OF MARINE EXPLORATION AND FISHERIES IS RESPONSIBLE FOR THE DEVELOPMENT POLICIES ON FISHERIES INCLUDING AQUACULTURE.



FOR FURTHER INQUIRIES, CONTACT :

THE DIRECTOR
DIRECTORATE GENERAL OF FISHERIES
JALAN HARSONO RM. NO. 3
RAGUNAN, PASAR MINGU
JAKARTA 12550
PHONE/FAX : (62-21) 781 5630
E-mail-hartati-ditjenkan@deptan.go.id

Training, websites, extension materials **NOTICES**

Year 2001 AQD TRAINING COURSES

Freshwater Aquaculture	April 18 to May 17 (4 weeks)
Management of Sustainable Aquafarming Systems (includes module on Aquaculture Management)	May 9 to June 14 (5 weeks)
Marine Fish Hatchery	June 5 to July 13 (5 weeks)
Fish Nutrition	Oct 10 to Nov 15 (5 weeks)
Third Country Training Program on Responsible Aquaculture Dev't (TCTP)	By invitation, to be scheduled later

For application forms and further information, please contact:

Training and Information Division
SEAFDEC Aquaculture Department
Tigbauan, Iloilo 5021, Philippines
Tel/fax: 63 (33) 336 2891, 335 1008
E-mail: training@aqd.seafdec.org.ph

For local applicants who wish to apply for fellowships, contact:

Hon. Cesar Drilon, SEAFDEC Council Director for the Philippines
Office of the Undersecretary for Fisheries and Legislative Affairs
Department of Agriculture, Elliptical Road, Diliman, Quezon City 1104
FAX: (02) 927 8405

For fellowship applicants from other countries,
please contact your respective SEAFDEC Council Director.

SEAFDEC websites on the internet

- **www.seafdec.org**
maintained by the SEAFDEC Secretariat and SEAFDEC Training Department in Samut Prakan (Thailand) with contributions from the various SEAFDEC departments. Regional programs are highlighted
- **www.seafdec.org.ph**
all about the SEAFDEC Aquaculture Department based in Iloilo, Philippines
- **www.asean.fishnet.gov.sg/mfrdl**
all about the SEAFDEC Marine Fishery Research Department based in Singapore
- **www.agrolink.moa.my/dof/seafdec**
all about the SEAFDEC Marine Fishery Resources Development and Management based in Kuala Terengganu, Malaysia

Videos from SEAFDEC/AQD

Milkfish hatchery operations, 12 minutes. Describes SEAFDEC/AQD's recommended mode of operations for a milkfish hatchery.

A CFRM experience: the Malalison story, a 30-minute video documentary that shows the lessons gained by SEAFDEC's 7-year coastal fishery resource management project (CFRM) in Malalison Island, west central Philippines.

Culture of oyster and mussel using raft method, a 9-minute documentary that depicts the AQD favored method of using the environment-friendly hanging raft for oyster and mussel culture.

Grouper cage culture, 16 minutes. Promotes a profitable way of raising grouper in cages. Describes briefly the processes of site selection, cage construction, and grow-out culture.

Grouper culture in brackishwater ponds, an 8.5-minute video documentary showing the different stages of grouper culture: grow-out, harvest, and post-harvest, as well as site selection and pond preparation. It also describes the economics of one grouper crop, and marketing and transport techniques.

Conserving our mangrove resources, a 12-minute video documentary that describes the plight of mangroves in the wake of the fishpond boom and efforts to sustain the mangroves.

Price for each video title: P500 within the Philippines; US\$45 for other countries. Postage is included in price. Kindly indicate format of VHS tape (eg. NTSC, PAL, etc). See next page for ordering address.

New publications



Mangrove-friendly aquaculture, the 217-page proceedings of the first regional workshop of the same name. It contains 3 review papers, and country status papers from the Philippines, Japan, Thailand, Vietnam, Myanmar, Brunei Darussalam, Indonesia and Cambodia. Price: P300 in the Philippines, US\$50 other countries (includes postage).

NEW BOOKS / FLYERS / VIDEOS from SEAFDEC Aquaculture Department

New publications (con't)

Diseases of penaeid shrimps in the Philippines, a 83-page second edition of a book first published in 1988. Of the 25 major diseases described, five are new. Entries have been updated, and include causative agent, penaeid species and stages affected, gross signs, effects on host, preventive methods and treatment. *Price (includes postage): P200 in the Philippines, US\$ 45 other countries.*

Netcage culture of tilapia in dams and small farm reservoirs, a 14-page manual that gives details on net cage design and farm management. Profitability analysis is also included. *Price (includes postage): P80 in the Philippines, US\$ 30 other countries.*

Ecology and farming of milkfish, a 117-page monograph that discusses the life history and ecology and various aspects of the farming industry in the Philippines. *Price (includes postage): P300 in the Philippines, US\$50 other countries.*

Mudcrab, a 32-page manual that gives a general overview of mudcrab species of commercial value and their grow-out monoculture in ponds; polyculture with milkfish; and fattening in ponds, mangroves, and cages. *Price (including postage): P100 in the Philippines, US\$ 35 other countries.*

Mudcrab Scylla spp. production in brackish-water ponds, a 14-page manual that covers the specifics of grow-out

NEW BOOKS / FLYERS / VIDEOS from SEAFDEC Aquaculture Department

Aquaculture training program. 20-page brochure that introduces SEAFDEC/AQD's short-term regular courses.

Training Module on Sustainable Aquaculture and Coastal Resource Management. Describes the new SEAFDEC/AQD training course (including course content), qualification of participants, and enrollment process.

These flyers and brochures are free upon request. They can also be downloaded from the AQD website - www.seafdec.org.ph

send video / book orders / newsletter subscription to:

Sales / Circulation
SEAFDEC Aquaculture Department
Tigbauan 5021, Iloilo, Philippines

Fax 63 (33) 336 2891, 335 1008
E-mail sales@aqd.seafdec.org.ph

newsletter subscription



SEAFDEC Asian Aquaculture reports on sustainable aquaculture. It is intended for fishfarmers, aquaculturists, extensionists, policymakers, researchers, and the general public.

It comes out six times a year.

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*Payment can be made in the form of Bank Draft / Check in US Dollars drawn on any US Bank or Money Order in Philippine Pesos made payable to **SEAFDEC Aquaculture Department**

Message

The SEAFDEC family (now composed of nine Member Countries from Asia) is proud to welcome Indonesia as its new member. Indonesia's membership strengthens SEAFDEC's presence in the ASEAN region as innovations in fish production find their way into the member countries' programs and policies.

The new SEAFDEC strategic plan has directed SEAFDEC orientation toward regional issues. Programs and policies being formulated are now assured of approval, acceptance, and implementation in a wider area of coverage. An example of this is the initiation of regional guidelines for the implementation of the Code of Conduct for Responsible Fisheries with regard to aquaculture. Another example is the development of a mangrove-friendly shrimp culture technologies which have a special significance to Indonesia as it has 3,533,600 hectares mangrove areas.

Indonesia has much to share with SEAFDEC's other member countries as a country of great skills and experience in fisheries and aquaculture acquired over centuries. It has the technology for freshwater fish culture in rice fields, culture-based fisheries management in lakes and reservoirs, milkfish breeding, and others.

With this new association with Indonesia, SEAFDEC extends its vigorous influence in the ASEAN region especially in the areas of responsible fisheries and aquaculture that will assure coming generations of quality and sufficient fish supply.

Selamat datang!

Panu Tavarutmaneegul

SEAFDEC Secretary-General

Bangkok, Thailand



A postcard from Indonesia by an unknown artist courtesy of CR Lavilla Torres



Better life through aquaculture

SEAFDEC
Aquaculture
Department
P.O. Box 256
Iloilo City 5000
Philippines

E-mail:
devcom@aqd.seafdec.org.ph

Cover price, ₱ 50.00

Entered as second class mail matter at
PPC Tigbauan, Iloilo 21 July 1995



SEAFDEC Aquaculture Department supports the Philippine government's **Agrikulturang MakaMASA** program. This is the banner program of the Estrada Administration for modernizing the agriculture sector.

The goals of the program for the fisheries sub-sector are: (1) food security through sustainable development and management of fisheries resources; (2) socio-economic upliftment of subsistence fisherfolk; and (3) fisherfolk empowerment. The program components are as follows:

- fisheries production
- conservation and management
- fisheries training and extension services
- fisheries information and marketing support
- research and development in fisheries
- fisheries infrastructure
- rural finance for fisheries
- program organization and management for the fisheries sector